



Herbicide Selection and Management in Pome and Stone Fruit

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Herbicide Mode of Action



Herbicides target a specific plant enzyme, biochemical pathway, or reproductive function. This is called the **Mode of Action (MOA)**. The active place in the biochemical or reproductive pathway is called the **Target Site**.



MOA and Target Site



MOA and Target Site for herbicides in the same chemical family are similar. Using the same or related compounds may lead to crop injury or weed resistance. The more active a herbicide is, the greater the risk of weed resistance.



Chemical Families and



Representative Herbicides (1)

Family	Herbicide	MOA
Substituted Urea	Karmex, Lorox	Photosystem II Inhibitor
Substituted Uracil	Sinbar, Hyvar X	Photosystem II Inhibitor
Triazine	Princep, Aatrex	Photosystem II Inhibitor



Chemical Families and



Representative Herbicides (2)

Family	Herbicide	MOA
Sulfonylurea	Matrix, Sanda	Acetolactase Synthase Inhibitor
Dinitroaniline	Prowl, Surflan	Mitosis Inhibitor
Diphenylether	Goal, Blazer	Protoporphyrinogen Oxidase Inhibitor



Chemical Families and



Representative Herbicides (3)

Family	Herbicide	MOA
Triazolinone	Aim, Spartan	PPO Inhibitor
Phenyl-Phthalimide	Chateau	PPO Inhibitor
Pyrimidinedione	Treevix (Kixor)	PPO Inhibitor



Chemical Families and



Representative Herbicides (4)

Family	Herbicide	MOA
Nitrile	Gallery, Casoron	Cellulose Synthesis Inhibitor
Pyridazinone	Solicam	Pigment Inhibitor
Triketone	Callisto	Carotenoid Synthesis Inhibitor



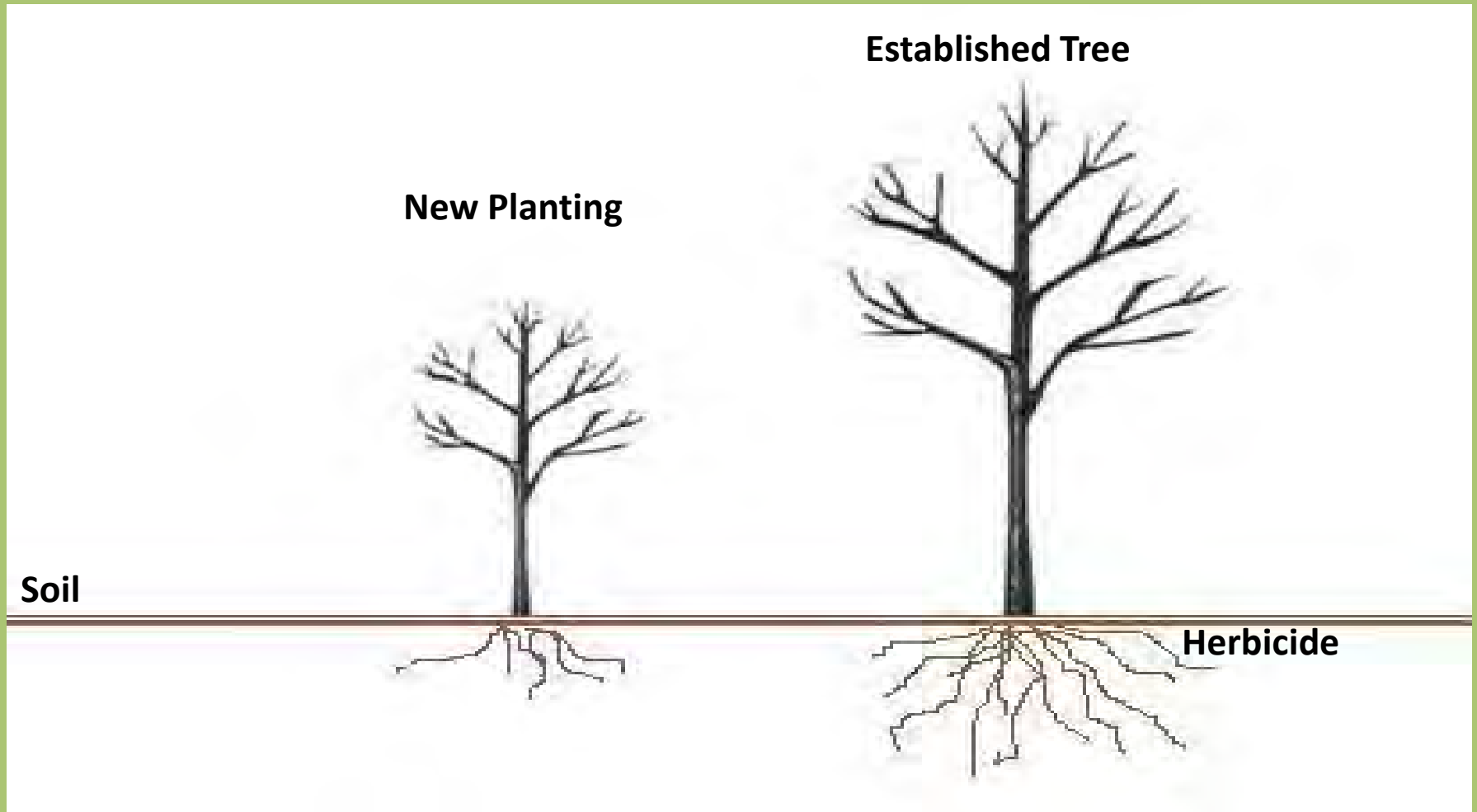
Methods of Selectivity



- Metabolism of the herbicide
 - Placement in time or space
 - Plant anatomical differences
 - Resistance at site of action
 - Differences in stage of growth
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Fruit Tree Selectivity



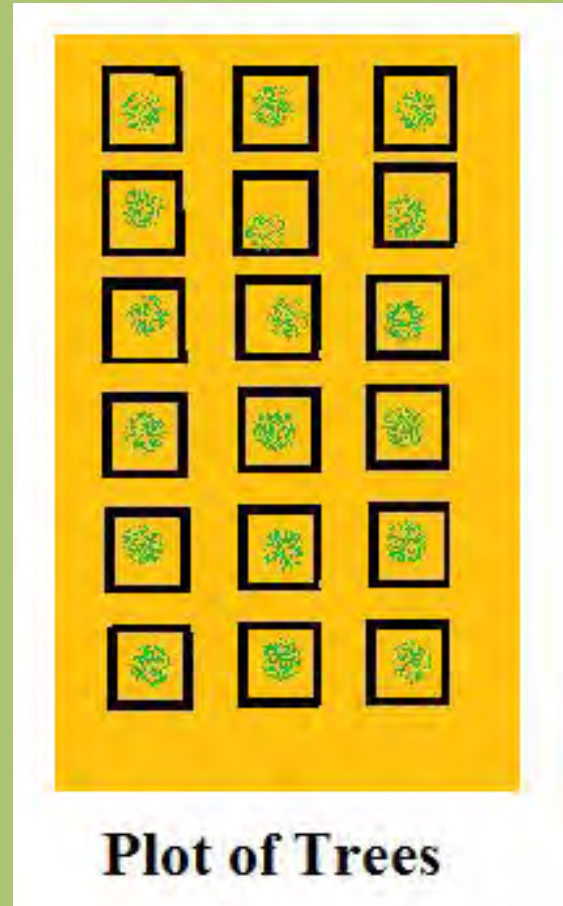
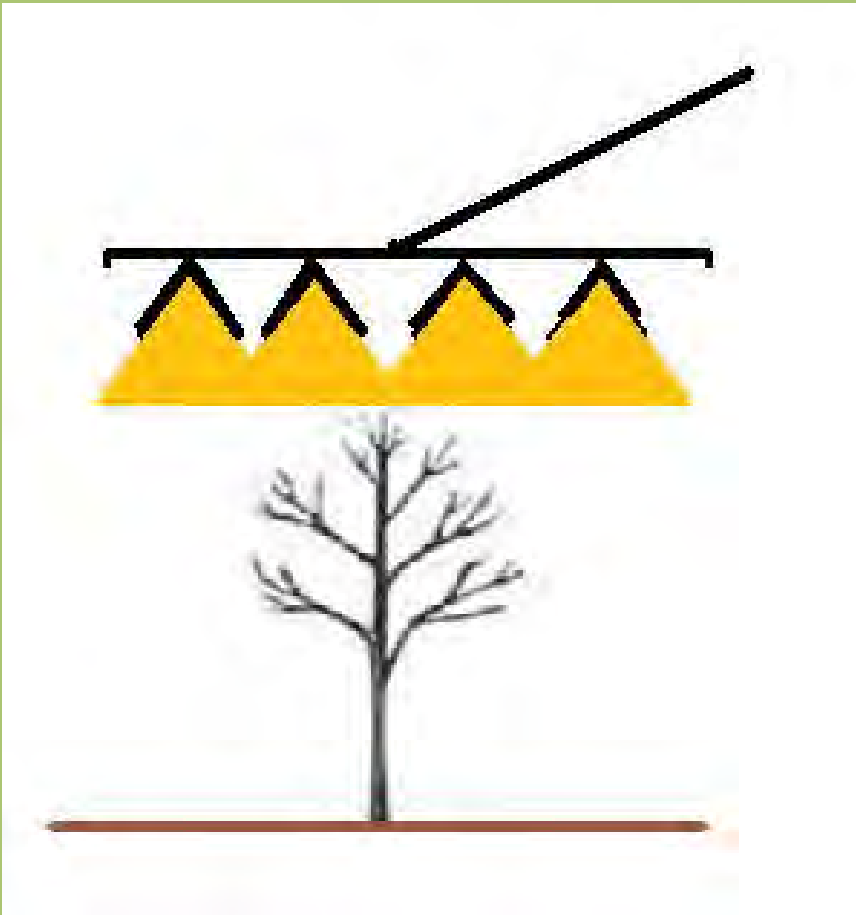


Directed Application





Broadcast Application





Leaching Potential



- The more soluble a herbicide is the greater the potential for leaching into the root zone and for crop injury.
 - Sandy soil with less than 1% organic matter is very porous and herbicides may leach into tree root zone. Observe label precautions about soil type and herbicide rates.
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Residual Herbicides for Tree Fruit (1)



<u>Herbicide</u>	<u>MOA</u>	<u>Solubility</u> <u>(ppm)</u>	<u>Half Life</u> <u>(days)</u>
Surflan	Mitosis Inhibitor	3.0	20
Prowl H2O	Mitosis Inhibitor	0.3	44
Devrinol	Mitosis Inhibitor	73	70
Kerb	Mitosis Inhibitor	15	60



Residual Herbicides for Tree Fruit (2)



<u>Herbicide</u>	<u>MOA</u>	<u>Solubility</u> <u>(ppm)</u>	<u>Half Life</u> <u>(days)</u>
Trellis (Gallery)	Cellulose Synthesis Inhibitor	1.0	120
Casoron	Cellulose Synthesis Inhibitor	21	60
Alion	Cellulose Synthesis Inhibitor	3	?



Residual Herbicides for Tree Fruit (3)



<u>Herbicide</u>	<u>MOA</u>	<u>Solubility</u> <u>(ppm)</u>	<u>Half Life</u> <u>(days)</u>
Chateau	PPO Inhibitor	2	20
Goal	PPO Inhibitor	0.1	35
Treevix	PPO Inhibitor	2100	17



Residual Herbicides for Tree Fruit (4)



<u>Herbicide</u>	<u>MOA</u>	<u>Solubility</u> <u>(ppm)</u>	<u>Half Life</u> <u>(days)</u>
Matrix	ALS Inhibitor	10	4
Sandea	ALS Inhibitor	15	30
Mission	ALS Inhibitor	2100	16



Residual Herbicides for Tree Fruit (5)



<u>Herbicide</u>	<u>MOA</u>	<u>Solubility</u> <u>(ppm)</u>	<u>Half Life</u> <u>(days)</u>
Karmex	PSII Inhibitor	42	90
Princep	PSII Inhibitor	2	60
Sinbar	PSII Inhibitor	710	120



Postemergence Herbicides



for Tree Fruit (1)

<u>Herbicide</u>	<u>MOA</u>	<u>Solubility</u> <u>(ppm)</u>	<u>Half Life</u> <u>(days)</u>
Roundup	EPSPS Inhibitor	15K	45
Gramoxone	PSI Inhibitor	620K	1000
Fusilade DX	ACCCase Inhibitor	1	15
Poast	ACCCase Inhibitor	4400	5
Select	ACCCase Inhibitor	10	3



Postemergence Herbicides



for Tree Fruit (2)

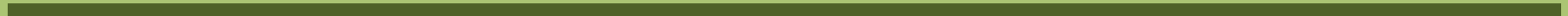
<u>Herbicide</u>	<u>MOA</u>	<u>Solubility</u> <u>(ppm)</u>	<u>Half Life</u> <u>(days)</u>
Rely 280	Glutamine Inhibitor	1370K	7
Aim	PPO Inhibitor	12K	0
Venue	PPO Inhibitor	1	7
Treevix	PPO Inhibitor	2100	17
Sandea	ALS Inhibitor	15	30



Adjuvants



- Material added to the spray mixture that helps overcome spray barriers and disruptors.





Spray Barriers



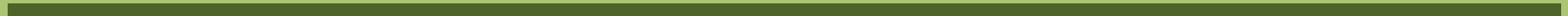
- Natural plant characteristics that reduce herbicide contact or in other ways reduce effectiveness of herbicides.
 - Eg: Leaf angle, cuticle wax, leaf hairs, growth habit, plant size, reproductive stage, level of dormancy.
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Spray Disruptors



- Factors other than plant physiology and morphology that cause reduced effectiveness of herbicides.
- Eg: Hard water, high pH water, tank mix components, wind, rain.





Types of Adjuvants



1. Activator Agents – overcome plant spray barriers.
 2. Spray Modifier Agents – modify physical and mechanical barriers.
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Activator Agents

1. Nonionic Surfactant (NIS) – 80-90% long-chain alcohol.
2. Crop Oil Concentrate (COC) – 80% petroleum oil and 20% surfactant.
3. Methylated Seed Oil (MSO) – Oil concentrate from soybean oil; usually 100% oil.



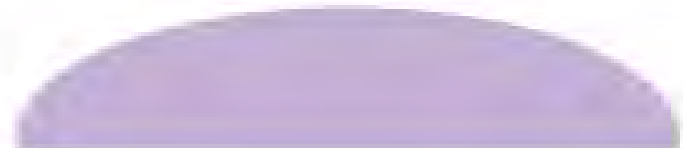


Effects of Adjuvants on Spray Droplets



Leaf Surface

Spray droplet without
surfactant on waxy leaf



Spray droplet with surfactant on
waxy leaf



Spray Modifier Agents



1. Acidifiers – eg LI700
 2. N Fertilizer – urea, ammonium nitrate
 3. Compatibility Agents
 4. Anti-Foam
 5. Sticker
 6. Drift Control
 7. Silicone Surfactants – Silwet L-77, Sylgard 309
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Adjuvant Selection



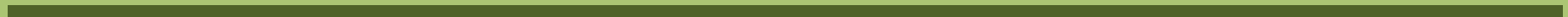
1. Nonionic Surfactant (NIS) for most postemergence herbicide application.
 2. Crop Oil Concentrate (COC) for herbicides that recommend it on the label.
 3. Methylated Soybean Oil (MSO) for some ALS inhibitors.
 4. Acidifier for hard water if $\text{pH} > 7$.
 5. Sticker spreader for insecticide and fungicide application.
 6. Drift retardant for blast sprayers.
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Optimum Weed Control



1. Know your weeds.
2. Know your herbicides.
3. Know your crop.





Weeds

1. Identify weeds to family and genus if possible.
 2. It is normally easier to control weeds preemergence than postemergence.
 3. For perennials, attack them at several stages during the year.
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Weed Identification



Websites

- Weed Science Society of America Weed ID:
 - <http://www.wssa.net/Weeds/ID/index.htm>
 - Identifying Weeds in Field Crops:
 - <http://www.ipm.msu.edu/weeds-field.htm>
 - MSU Turf Weeds:
 - <http://msuturfweeds.net/>
 - Midwestern Turfgrass Weed Identification and Control:
 - http://www.turf.uiuc.edu/weed_web/index.htm
 - University of Illinois Weed Science:
 - <http://weeds.cropsci.illinois.edu/weedid.htm>
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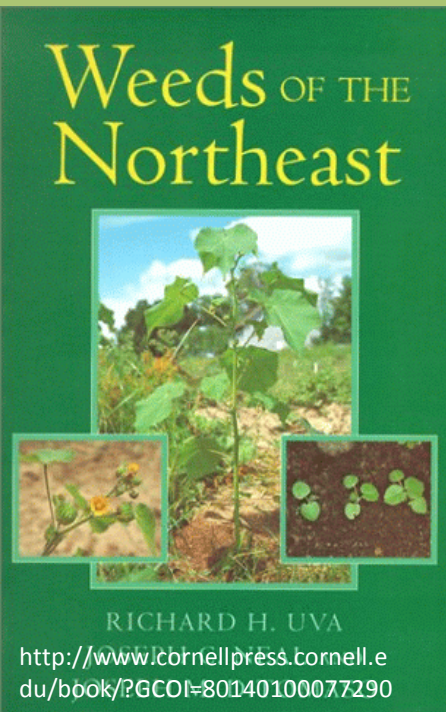
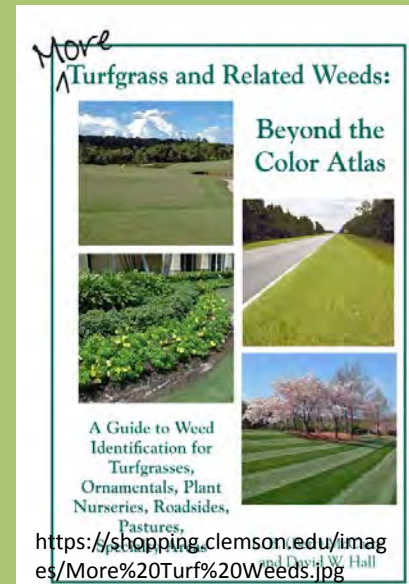
Weed Identification



Publications (1)

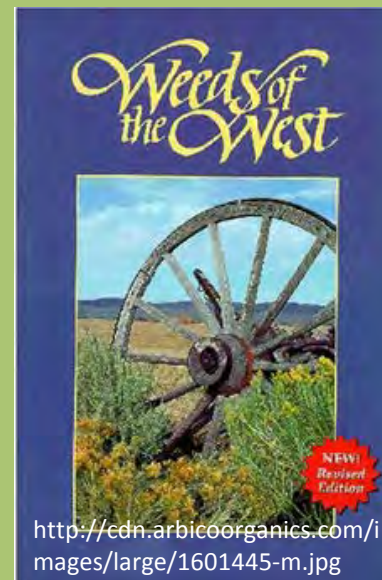
“More Turfgrass and Related Weeds: Beyond the Color Atlas”

-L.B. McCarthy & D.W. Hall



“Weeds of the Northeast”

-R. Uva, J. Neal, and J. DiTomaso



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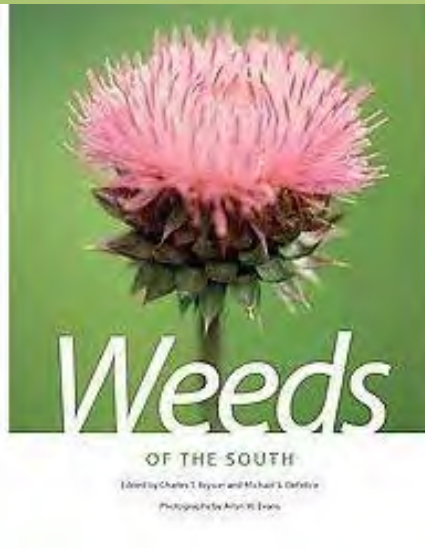


Weed Identification

Publications (2)

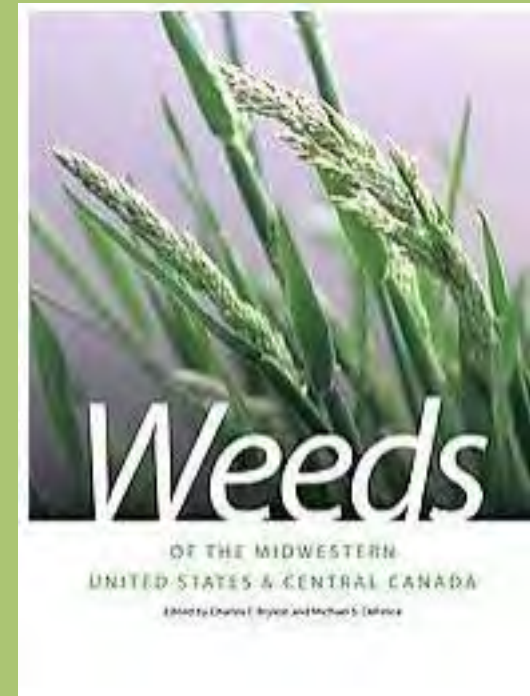


<http://images.bizrate.com/resize?sq=254&uid=952080805>



“Weeds of the South”
-Charles T. Bryson
& Michael S. DeFlice

“Weeds of the Midwestern
United States & Central Canada”
-Charles T. Bryson &
Michael S. DeFelice



http://dl2.shoppingshadow.com/images/pi/b8/5e/de/2049802702-260x260-0-0_Book_Weeds_of_the_Midwestern_United_States_and_Cen.jpg



Herbicides

1. Know the Mode of Action (MOA). Use at least 2 MOA preemergence. Apply preemergence herbicides in fall and spring. Rotate MOA each year.
 2. Include glyphosate in fall and spring, preemergence applications to kill biennials and winter annuals.
 3. Use postemergence herbicides during the growing season to kill emerged weeds. Some weeds can be killed only postemergence. Observe PHI's.
 4. Be aware of potential crop injury.
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Crop

1. Each crop has specific herbicide registrations.
Do not assume all trees are the same.
 2. Young trees are more susceptible; roots are shallow and bark is thinner.
 3. Watch for crop injury symptoms.
 4. Maintain good pesticide records.
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A Weed Control Program



For Apple (1)

Year 0

Fall: **Chateau** 8-10 oz + glyphosate 1 qt

Year 1

Spring: **Sinbar** 1 lb or **Karmex** 3 lb

June: glyphosate 1 qt + **Venue** 2 oz

Fall: **Alion** 5 oz + glyphosate



A Weed Control Program



For Apple (2)

Year 2

Spring: **Matrix** 4 oz + **Karmex** 3 lb + glyphosate

June: **Treevix** 1 oz + **Venue** 1 oz

Fall: **Solicam** 4 lb + **Casoron CS** 1.4 gal + glyphosate

Year 3

Spring: **Princep** 4 lb + **Surflan** or **Prowl** 4 qt

June: **Rely 280** 3 pt + **Venue** 1 oz

Fall: **Chateau** 8-10 oz + glyphosate



A Cherry Weed Control



Program (1)

Year 0

Fall: **Chateau** 6-10 oz + glyphosate 1 qt

Year 1

Spring: **Prowl** 4 qt + **Matrix** 4 oz

June: glyphosate 1 qt or **Aim** 2 oz + **Venue** 2 oz

Fall: **Alion** 5 oz + glyphosate



A Cherry Weed Control



Program (2)

Year 2

Spring: **Goal Tender** 2 qt + **Surflan** 2 qt

June: **Gramoxone** 2 qt (28 day PHI) + **Venue** 2 oz

Fall: **Chateau** 0-1 oz + glyphosate 1 qt

Year 3

Spring: **Prowl** 4 qt + Matrix

June: **Gramoxone** 2 qt + **Venue** 2 oz

Fall: **Alion** 5 oz + glyphosate



New Labels Coming for Tree Fruit



- **Mission** (flazasulfuron) – Long residual
 - **Trellis** (isoxaben) – Long residual
 - **Spartan** (sulfentrazone) – Composite + pigweed control
 - **Stinger** (clopyralid) – Post composite, legume, nightshade
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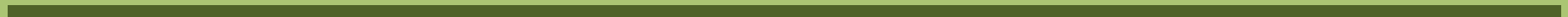
Special Weed Problems



Yellow Nutsedge – **Sandea** – Post

Quackgrass – **Kerb** – Fall

Annual Bluegrass – **Select Max**





The End

