HS-795

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Weed Control in Florida Citrus[1]

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Introduction

Citrus is one of the most important agricultural crops in Florida, comprising 850,000 acres with an on-tree value of $1.15 billion for the 1998-99 crop year. Florida's citrus industry consists of oranges (78%), grapefruit (16%), and specialty varieties (6%). Control of weeds is a major economic cost, estimated at $172.8 million or 25% of annual production budget. Total production costs per acre is estimated at $850 which includes weed control cost of $205 per acre. An estimated 90% of the acreage receives some form of chemical weed control as well as mechanical control.

Florida's favorable climate allows for weed germination and year-round growth. Weeds compete with citrus trees for nutrients, light, water, space and harbor insects and rodents that attack citrus trees. Additionally, weeds increase cold damage during radiation freezes, increase the incidence of *Phytophthora* foot rot, impede harvesting of citrus crops, interfere with low volume irrigation systems, and intercept soil-applied chemicals. Thus, the objective of today's citrus weed management program is the suppression of the undesirable effects of weed populations to an acceptable level.

Weed Control

Chemical weed control minimizes hand labor, increases tree growth, reduces damage to tree trunks, and improves movement within the grove. When properly selected and applied for specific tree age, scion, and soil type, herbicides will not injure healthy citrus trees. Positive responses in tree trunks and canopy volume have been noted when weeds are controlled which promotes greater production.

Herbicides used in groves are divided into two groups: soil-applied preemergence (Table 1), and foliar-applied postemergence (Table 2). The postemergence herbicides can be further divided into systemic or contact. Commonly used preemergence herbicides for the control of grasses include: bromacil (Hyvar), norflurazon (Solicam), oryzalin (Surflan), and thiazopyr (Mandate). Preemergence herbicides for the control of broadleaf weeds include: diuron (Diuron, Karmex, Direx), oxyfluorfen (Goal), and simazine (Princep, Simazine). Soon to be released, azafenidin (Milestone) controls both broadleaf and grass weeds. Postemergence herbicides include non-selective paraquat (Gramoxone), glyphosate (Roundup), sulfosate (Touchdown), and selective grass control herbicides are fluazifop-P-butyl

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(Fusilade) and sethoxydim (Poast Plus). Control of specific weeds is dependent on herbicide selection (Table 3), application rate, and weed species. For the effective control of all weed species (broadleaf and grasses) combinations of products may be necessary to achieve successful control.

Weed control methods include preventative, chemical, chemical mowing, mechanical, biological, and hand labor. Hand labor is minimized due to its high cost and uncertain availability.

Materials

The average of three 120 days after treatment (DAT) visual ratings for twelve months were averaged to determine the annual weed control rating for selected herbicide combinations (Table 4). Rating percentages are for combinations of broadleaf, grasses, and sedges. The rating scale is 0 to 100, with 0% being complete ground cover and 100% completely weed free. Herbicide application rates varied due to weed intensity at study sites. All applications were made with a tractor mounted sprayer applying 30 gpa at approximately 120-day intervals. Treatments were applied to 5 tree plots replicated 5 times in a randomized complete block design to a young grove on the ridge (Lake Garfield) and flatwoods (Indiantown).

Conclusions

Herbicide combinations which controlled both grasses and broadleaf increased percent weed control. Herbicide combinations that included bromacil or norflurazon generally provided higher levels of weed control. Weed intensities vary among the different locations within the state with higher weed pressure being in the south Florida flatwoods area. Herbicide rates must be adjusted to control the weeds present at a given site. Herbicide products and/or rates that work at one location may not provide effective control at other locations. A clear understanding of weed species present and knowledge of species that are controlled by a given herbicide are important.

Weed control of approximately 80% at the end of the rating period (every 120 days after treatment) should provide acceptable control under most conditions. Complete weed control (100%) is not necessary, may not be cost effective and could pose environmental risks. Seasonal differences in weed control will occur, with lower levels of weed pressure occurring during the winter months.

References

Florida Citrus Pest Management Guide, SP-43, University of Florida, Florida Cooperative Extension Service. 1990-2000.

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Tucker, D. P., R. L. Phillips, & T. W. Oswalt. 1971 & 1976. Weed Control Guide for Florida Citrus. Florida Cooperative Extension Service, University of Florida, Gainesville, Circular 355.

Table 1. Preemergence Herbicides Currently Used in Florida Citrus

Common Name	Year Introduced	Current Recommendations		
		Application Site	Rate (lb ai/A)*	Maximum Per Year (lb ai/A)*
Bromacil**	1963	< 1 year	1.6-2.4	4.8
		1-3 years	1.6-2.4	4.8
		> 4 years	1.6-3.2	4.8
Diuron	1962	< 1 year	1.6	6.4
		> 1 year	1.6-3.2	6.4
Norflurazon	1985	all	2.4-4.0	8.0
Oryzalin	1993	all	2.0-4.0	6.0
Oxyfluorfen***	1989	non-bearing	0.5-2.0	4.0
Thiazopyr	1997	all	0.56-0.84	1.0
Simazine	1962	< 1 year	2.25	
		> 1 year	2.25-3.96	7.9
Azafenidin	2000?		1.0	2.0

Labeled but not frequently used: Napropamide (Devrinol), Pendimethalin (Prowl, Pendimax), Trifluralin (Treflan).
*Rate is converted to pounds active ingredient per acre (lb ai/A) to simplify table where multiple products exist.
**Prohibited from use in vulnerable, deep, sandy ridge type soils.
***Non-bearing only.

Table 2. Postemergence Herbicides Currently Used in Florida Citrus

Common Name	Year Introduced	Current Recommendations		
		Application Site	Rate (lb ai/A)	Maximum Per Year (lb ai/A)
Glyphosate	1979	undertree annual weeds	1.0-2.0	10.5
		undertree perennial	2.0-5.0	
		middle management	0.14-0.28	
			(bahiagrass) 0.125-0.25	
			(bermudagrass) 0.25-0.375	
		spot treatment	1-2% solution	
Sulfosate	1992	undertree	1.0-2.0 (annual weeds)	4.0
			2.0-4.0 (perennial weeds)	
Paraquat	1969	all	0.625-1.0	
Fluazifop-P-butyl	1987	non-bearing	0.25-0.375	
Sethoxydim	1993	all	0.28-0.46	1.875

Table 3. Weed Control by Various Products

	50% Grove Acreage				50% Grove Acreage
	Undertree - Broadleaf		Undertree-Grasses		Row Middle
	PRE	POST	PRE	POST	Chemical Mow
Chemical					
Bromacil*			x	limited	
Norflurazon	limited		x		

Table 3. Weed Control by Various Products

	50% Grove Acreage				50% Grove Acreage
	Undertree - Broadleaf		Undertree- Grasses		Row Middle
	PRE	POST	PRE	POST	Chemical Mow
Thiazopyr			x		
Oxyfluorfen**	x				
Simazine	x		limited - annual grasses		
Diuron	x		limited - annual grasses		
Oryzalin	limited		x		
Azafedin***	x		x		
Glyphosate/Sulfosate		x		x	x
Paraquat		x		x	
Sethoxydim				x	
Fluazifop-P-butyl**				x	
Biological					
Phytophthora palmivora	Milkweed vine only				
Mechanical					
discing / mowing	limited control of grasses and broadleaf due to inability to get under tree				control broadleaf and grasses

PRE = Preemergence.
POST = Postemergence.
x = Control (rate and weed species dependent).
*Prohibited from use on ridge citrus. See label.
**Non-bearing only.
***Registration pending.

Table 4. Preemergence Herbicide Treatments and Annual Overall Weed Control (%) for the Ridge and Flatwoods Citrus Production Regions

Herbicide***	Ridge		Flatwoods	
	Rate (lb ai/A)	Control (%)*	Rate (lb ai/A)	Control (%)*
Bromacil****	1.6	91 a	2.13	81 b
Diuron	1.6	74 bcd	2.13	59 cde
Bromacil + Diuron****	1.6 + 1.6	92 a	2.13 + 2.13	91 a
Diuron + Oryzalin	1.6 + 1.6	79 bc	2.13 + 2.0	63 cd
Diuron + Thiazopyr	1.6 + 0.25	74 b-e	2.13 + 0.33	60 cd
Diuron + Thiazopyr	1.6 + 0.33	76 bcd	2.13 + 0.49	66 c
Norflurazon	1.6	70 b-e	2.4	81 b
Norflurazon + Diuron	1.6 + 1.6	81 b	2.13 + 2.4	92 a
Norflurazon + Simazine	1.6 + 1.8	73 b-e	2.4 + 2.64	89 ab
Norflurazon + Oxyfluorfen**	1.6 + 0.8	81 b	2.4 + 1.2	88 ab
Oryzalin	1.6	64 def	2.0	37 hi

Table 4. Preemergence Herbicide Treatments and Annual Overall Weed Control (%) for the Ridge and Flatwoods Citrus Production Regions

Herbicide***	Ridge			Flatwoods		
	Rate (lb ai/A)	Control (%)*		Rate (lb ai/A)	Control (%)*	
Oxyfluorfen**	0.8	69	cde	1.2	55	c-g
Oxyfluorfen** + Thiazopyr	0.8 + 0.25	76	bcd	1.2 + 0.375	64	cd
Oxyfluorfen** + Thiazopyr	0.8 + 0.33	78	bc	1.2 + 0.49	61	cd
Simazine	1.8	53	f	2.64	47	e-h
Simazine + Oryzalin	1.8 + 1.6	75	bcd	2.64 + 2.0	57	c-f
Simazine + Thiazopyr	1.8 + 0.25	69	cde	2.64 + 0.375	64	cd
Simazine + Thiazopyr	1.8 + 0.33	72	b-e	2.64 + 0.49	53	d-g
Thiazopyr	0.25	62	ef	0.375	46	fgh
Thiazopyr	0.33	68	cde	0.49	42	gh
Control	0.0	39	g	0.0	29	i

Means followed by same letter within a column do not significantly differ (P<=0.05 Waller-Duncan). Percent control data were transformed using arcsin square root percent and are reported in de-transformed units.
*Annual weed control based upon the average of 3 treatments per year with ratings at 120 DAT after each treatment.
**Non-bearing.
***All treatment, including control, included glyphosate at 2.0 to 3.0 lb ai/A.
****Prohibited from use in ridge citrus. See label.