HS-107

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2011 Florida Citrus Pest Management Guide: Weeds[1]

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Weed management in Florida citrus is an important component of any successful integrated pest management (IPM) program. IPM programs utilize a combination of control practices including, but not limited to, cultural, preventive, mechanical, chemical, or biological methods. Weed management is expensive and a major component in the total citrus production program. Time spent developing this production program can provide significant economic and environmental returns. The goal of weed management is to minimize the competitive effect of weeds with the citrus tree, be that young or mature. An understanding of the growth and competitive nature of the weed is important. The objective of today's weed management program is to suppress and control weeds so that they do not cause damage to the tree, impact yield, or impede grove and harvesting operations. Complete and total elimination of all weeds from the grove floor is unnecessary and not warranted.

When developing a weed management program, growers must consider: 1) application site (tree age, soil type, and location including ridge vs. flatwoods and county limitations); 2) weeds present; 3) the stage of weed growth; 4) herbicide selection; 5) spray nozzle and herbicide band width; 6) spray volume and pressure; and 7) amount of herbicide used. All of these factors will directly affect cost and the success of the weed management program.

Tree Age and Variety

From years of experience and trials, growers know that weed growth is greater in young groves as compared to mature groves. Generally speaking, young groves will require greater attention to material selection and rate because the areas around the tree are more sun-exposed and have greater weed pressure than do larger trees, which have greater shaded areas with lower weed pressure. An exception to lower weed pressure for mature trees is where vines are present. Vines can germinate in shaded areas and grow into the tree canopy, creating a host of problems for the tree and fruit harvesting operations. Young trees generally will not tolerate herbicide rates as high as mature trees. Additionally, weeds compete with young trees for nutrients, water, light, and space at a greater rate compared to mature trees.

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When using herbicides for weed control, rates should be adjusted for tree age, with lower rates on young trees. Also be aware that some herbicide products may only be labeled for nonbearing sites, which means that product can only be applied if a crop is not going to be harvested within 12 months.

Consideration should also be provided as to product selection based upon variety. Some products specify that it may only be used on oranges, thus prohibiting its use on tangerines.

Impact of Weeds on Tree Growth

Weeds can impact tree growth and subsequent yields by altering the spray pattern of low volume irrigation systems, intercepting soil-applied chemicals (fertilizer and agricultural chemicals), reducing grove temperatures during freeze events, and interfering with harvesting operations. The presence of weeds in a grove can also affect insect populations and disease incidences.

Ground cover, in the row middles, also plays an important role in grove management by reducing soil erosion, sand blasting during windy conditions and retention of nutrients, but can also impact tree growth when allowed to compete with the citrus tree. Sod-forming bahia and bermuda grasses are typically used as ground cover between the tree rows, but bermuda can be more competitive than bahia. Ground covers can be beneficial if it is less competitive than other weeds that may be present in the grove. Thus, the selection of row-middle vegetation is an important consideration in IPM.

Direct reduction in citrus tree growth and yield can occur when weeds compete with trees for light, water, nutrients, and space. However, not all weeds compete with citrus trees in the same way or with the same level of competition. Water requirements for vegetation regrowth after mowing can impact water availability within the grove. During this regrowth period, grasses use more water from the soil compared to broadleaf plants. Vines can be more competitive for sunlight than other plants. Weeds can also compete with citrus trees in many ways, but with varying intensities. The ability of plants to intercept varying levels of water, light, and nutrients makes some weeds more competitive with citrus than other species. Therefore, highly competitive weeds should be of great importance to the production manager. Successful weed control is extremely important in groves which contain weeds that are highly competitive. In an IPM program, the most competitive weeds are identified and removed before they produce seeds. With time, seeds in the soil can be reduced with suppression, cultural, and sanitation methods.

To ensure competitive weeds are suppressed, proper plant identification is a critical first step in developing an effective program. Weed species will vary with location, climate, season, soil type, previous site history, and current and past management programs. Scouting should be conducted in all areas in and near the grove but not limited to tree row, row middle, water furrows, ditch banks, fence rows, and adjacent off-site locations. Each of these sites may receive different cultural practices, but different weeds may be found. Scouting off-site locations may prevent small isolated problems from becoming larger problems. Since weeds emerge throughout all growing seasons, schedule weed surveys throughout the year. Scouting should occur even if weeds are not easily visible or appear to be dead. A rapid regrowth from perennial plants that appear to be dead can occur and is particularly problematic when replanting new trees into weed-infested sites. Scouting should be conducted by walking throughout the groves, as small, easy-to-control weed seedlings may go unnoticed when driving through the grove. If weeds are properly identified while in the seedling or vegetative stage, then proper control can be achieved through: 1) increased flexibility in timing control options; 2) possible reduced herbicide application rate; and 3) reduced impact from control measures.

When scouting for weeds, records should be developed and recorded as to species abundance, location, and identity. Changes over time can be tracked to provide control strategy effectiveness. When scouting a large area, it is common to find a large number of weed species. The species present will vary with season and location.

Weeds can be identified or grouped as: 1) broadleaf (including vines); 2) grass; or 3) sedge.

The identification of weeds can be aided by looking for specific characteristics of the plant. These specific characteristics can include shape of the leaves, stems, seed, seed head, plant size, root system, as well as the type and color of flowers, if present.

Weeds can be classified by their life cycle: annual, biennial, or perennial. Annual plants have a one-year life cycle, growing from seed, maturing, and producing seed for the next generation of plants in one year or less. Annuals can be further divided into summer (sprout in spring, grow, mature and produce seed and die before winter) or winter (sprout in the fall, grow, mature, produce seed and die before summer). Biennials have a two-year life cycle, growing from seed and developing a heavy root system the first year, followed by seed production in the second year and then plant death. Perennials live more than two years with seed production occurring as early as the first year.

Detailed information on weed identification in citrus groves is available from the following UF/IFAS EDIS publications: HS-926 Identification of Vine Weeds in Florida Citrus, HS-896 Identification of Broadleaf Weeds in Citrus, HS-955 Identification of Grass Weeds in Florida Citrus, HS-962 Identification of Sedge and Sedge-Like Weeds in Florida Citrus; and the IFAS Extension for-sale publication SP341 Identification of Weeds in Florida Citrus, available at http://ifasbooks.com.

Weed Management Options

There are many approaches used to suppress and/or control weeds (vegetation) within the grove. These practices will vary with location, time (season), tree spacing, vegetation species present, cost, and grower preference. Each method of weed control has its own advantages and disadvantages.

Preventive

Preventive programs are often overlooked as a method of weed control. Preventive program entails the use of such practices as sanitation, spot spraying, or hand labor to prevent the source of weed infestation (seed and/or vegetative) from widespread dissemination throughout an area. By removing the undesirable weed species prior to seed development, dissemination by wind or mechanical transport on equipment can be effectively delayed. While preventive programs will not stop the spread of new weed species, these practices may slow the spread of undesirable weed species, thereby reducing the cost of current weed control programs.

Mechanical

Cultivation or tillage has been used in the past for many years in citrus production. Tillage is an effective method of controlling annual weeds effectively by severing stems and roots of the weeds but not very effective on perennial grasses. Tillage use is decreasing as a weed control method as more groves are planted on raised beds and tillage increases the chances for soil erosion. Additionally, tillage also damages the fibrous roots which are close to the soil surface, thus a main reason for reduction in use. These shallow fibrous roots close to the soil surface are very important in groves where the root systems are limited due to high water table, *Phytophthora* root rot, or root weevils. With the use of low volume irrigation systems and closer in-row planting distances, tillage in both directions is no longer possible.

Mechanical mowing is generally more expensive than tillage due to the cost of equipment and energy requirements. Mechanical mowing can also throw seed under the tree canopy, increasing weed pressure in the under canopy area of the tree.

The frequency of cultivation and/or mechanical mowing is dependent on the weeds present and season.

Chemical

Chemical weed control programs will vary from location to location within the state and can even vary within a given site based upon specific conditions such as soil type, variety, method of herbicide application, and the presence of specific weed species. Herbicides used in a grove are generally divided into two groups: 1) soil-applied preemergence herbicides that should be applied to fairly clean soil surfaces prior to weed emergence, and 2) foliar-applied postemergence herbicides that are applied after germination of weed seed.

Preemergence herbicides can be absorbed through emerging stems in the soil and/or roots. Preemergence herbicides are most effective before germination and early seedling growth stages.

Postemergence herbicides can be further divided into systemic or contact. Systemic herbicides are translocated within the target plant, killing the foliage and root system of the contacted plant. Contact herbicide kills only the plant parts which are contacted by the spray application. All herbicides used in citrus are selective in that they kill some plants (weeds) without significantly injuring other plants (citrus tree) if applied at the correct rate and manner.

Preemergence herbicides are generally applied two to three times per year, and the total annual amount of herbicide materials will be nearly the same, regardless of the application frequency. For preemergence materials, application should be properly timed so that the maximum amount of herbicide is in the upper soil profile (0 to 2 inches) slightly before peak weed emergence. Material applied too early will not have enough herbicide concentration to provide adequate weed control due to herbicide losses caused by leaching or degradation on the soil surface or within the soil profile.

Chemical Mowing

Chemical mowing use is increasing each year as the cost of mechanical mowing increases due to rising equipment, maintenance, and fuel costs. Chemical mowing consists of sublethal rates of systemic herbicide (glyphosate) to suppress the growth and/or regrowth for up to 45-90 days of grasses and broadleaf weeds that grow in the row middle. Prior to the chemical mowing application, the vegetation within the row middle is mowed and allowed to slightly regrow prior to the application of the chemical.

Chemical Weed Control Programs

Successful herbicide programs start with selecting the right herbicide or herbicide mixtures. All herbicides have a label that states the use requirements, application rates, weeds controlled and personal protective equipment required during mixing and/or application. Remember the label is the law and must be followed.

The herbicide use rate, the stage of weed growth, climate, and method of application can affect control. Climatic extremes including drought, flooding, and extreme temperatures that stress plants can result in reduced herbicide performance. Stressed plants take up and translocate less herbicide than non-stressed plants. Poor herbicide performance is minimized when the proper herbicide is selected, applied at recommended rates, in the correct spray volume, and to the right stage of the seedling's growth.

Selecting the proper herbicide requires an understanding of how herbicides work on plants. Herbicides applied to the soil before weed emergence are referred to as preemergence (Table 1). Herbicides can be applied directly to weeds, which are called postemergence (Tables 2 to 5).

Environmental Considerations

Herbicide selection should be based upon a number of factors, including weed species that are present or anticipated from weed surveys, vegetation developmental stages, product solubility and leaching potential, soil type at the location of application, rainfall distribution, county location, and other factors present on the product label.

Herbicides may move through the soil to groundwater if used improperly. Factors influencing the rate of herbicide movement in the soil include, but are not limited to, irrigation practices, rainfall, herbicide solubility, soil type, and organic matter. Information regarding the leaching potential for specific soils is available for herbicides and other agrichemicals for each county in Florida and can be found in UF/IFAS EDIS publications SL-40 Behavior of Pesticides in Soils and Water and SL-143 How Contaminants Reach Groundwater.

Additional consideration should be given to products containing bromacil, which is prohibited on deep, sandy, ridge-type soils; and some product labels restrict the annual application of diuron within Highlands County. Please consult your local county cooperative extension service or USDA-NRCS office for information on soil type restrictions.

Application Technology

Advances in herbicide application technology have resulted in the development of sophisticated equipment for the precision application of selected products within a grove setting. This sophisticated equipment is capable of selective delivery of multiple herbicide products, each directly injected or contained in multiple tanks that are injected into multiple lines or controlled by electronic sensors.

When applying preemergence herbicides via a herbicide boom, complete uniform coverage of the soil surface is important for improved weed control. Factors that can affect uniformity of coverage include worn or damaged nozzle tips, boom height, and vegetation present. As nozzles become worn, delivery rates increase and distribution patterns from the individual nozzles become distorted. Additionally, weeds present will also affect spray patterns as well as blocking the herbicide from reaching the soil surface when preemergence herbicides are being applied. The herbicide label may also state application equipment requirements. These requirements may include special herbicide boom designs which minimize material drift or potential contact with tree foliage.

Application pressure is also important as it affects the size of the spray droplets. Higher spray pressure decreases the spray droplet size, thus increasing the chances of off-target damage due to spray drift. Manufacturer's specified operation pressure range should be considered when selecting nozzles.

Additional information about herbicide equipment and its calibration can be found in the UF/IFAS EDIS Publication HS-1012 Citrus Herbicide Boom Sprayer Calibration.

Band Width

Application band width has a major impact on the amount of herbicide material applied per grove acre, thus directly affecting total weed control costs. When trees are small, herbicide band width should be rather narrow, only covering an area of 3 to 4 feet on each side of the tree. As the canopy width increases, the herbicide band width should likewise increase. Narrow band widths on small trees will aid in minimizing soil erosion and assist in maintaining water quality in bedded grove situations.

Herbicide Resistance Management

In many crops, the discovery of resistance to various herbicides has been well documented. Resistance is the ability of a specific weed to survive treatment with a given herbicide to which the species is normally susceptible. With repeated use of the same pesticide, the risk of herbicide resistance is increased. Due to its frequent and widespread use, glyphosate is a particular concern in Florida citrus. Weed resistance to glyphosate is a documented issue in numerous crop systems and should be expected. Rotating between herbicide classes will minimize the potential of the development of herbicide resistance. A listing of the recommended herbicides are provided in Table 6, which identifies the chemical class of each herbicide material.

Chemical Control of Root Sprouts

Various forms of glyphosate and triclopyr currently have label recommendations allowing these product to be use on recently cut citrus stumps. Triclopyr (Remedy Ultra) has an EPA 24(c) special local need registration for application to citrus stumps in Florida. This product should be applied in a manner to minimize application to the soil surface adjacent to the cut tree trunk.

Complete coverage of the cut surface will enhance control of vegetative regrowth from the stump. Stumps should be treated as soon as possible after cutting as effectiveness is reduced with time. If root grafting with desirable adjacent trees is present, the material may be translocated to healthy trees, causing significant damage.

Products should be applied in a manner that minimizes drift from the application site (cut stump) to adjacent tree(s).

Be sure to read and follow all label requirements.

Recommended Chemical Controls

Table 1. Preemergence Soil Residual Herbicides

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
Bromacil Hyvar X 80 WP	C1	Ridge: Do not use on vulnerable deep sandy, ridge-type soils. See product label under general precautions and use restrictions for specific soil series. Flatwoods: Do not exceed a total of 6 lb product per acre per year.	Controls annual and perennial grasses and annual broadleaf weeds. Postemergence activity, particularly with surfactant.
Trees 4 years and older		2-4 lb product. The higher recommended rates may be required for heavier soil types and for certain established perennial grass species. Apply prior to weed emergence or early postemergence.	
Trees established 1-3 years		2-3 lb product. Use lower recommended rates on lighter soils and/or in low weed infestation areas. Do not exceed maximum allowable yearly rates.	
Bromacil:Diuron Krovar I DF	C1, C2	Ridge: Do not use on vulnerable deep, sandy ridge-type soils. See supplemental product label for further details. Flatwoods: Do not exceed 12 lb product per acre per year.	Controls annual broadleaf weeds, annual vines, and annual and perennial grasses. Extra diuron in product increases activity on broadleaf weeds. Contact activity enhanced by surfactant.
Trees 3 years and older		4-6 lb product per acre. Apply prior to weed emergence or early postemergence.	
Trees established 1-3 years		2-4 lb product per acre. Do not exceed 8 lb per year. Use lower rates on lighter soils and/or in low weed infestation areas.	
Diuron	C2		
Direx 80DF		2-4 lb product	Controls annual broadleaf weeds and annual grasses. Contact activity enhanced by addition of surfactant. Foliage contacted by diuron may develop a bleached or bronzed appearance.
Direx / Diuron 4L		1.6-3.2 qt	
Karmex 80DF		2-4 lb product	
		Do not exceed 8 lb **(active ingredient)** per acre per year on flatwoods soils. Do not exceed 6.4 lb **(active ingredient)** per acre per year on ridge soils. In Highlands County, do not exceed 4.8 lb active ingredient per acre per year. Do not exceed 2 lb or 2 qt per application on trees less than 1 year old on shallow, poorly drained soils. Do not apply to row middles. Apply prior to weed emergence or early postemergence.	

Table 1. Preemergence Soil Residual Herbicides

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
Norflurazon Solicam 80DF	F1	2.5-5 lb of product per acre. Do not exceed 10 lb per year. For best results apply prior to weed emergence.	Controls annual and perennial grasses and certain broadleaf weeds. Spectrum of broadleaf weeds controlled increased by tank mixing with simazine or diuron. Suppresses established nutsedge and perennial grasses; control requires repeat applications. Dense weed growth should be controlled with contact or systemic herbicides prior to Solicam application to allow maximum contact with the soil surface. Tank mixes with postemergence contact or systemic herbicides may be used where weed growth is low growing and sparse. Solicam activity is highly dependent on good soil moisture following application, i.e., rainfall or irrigation. Contact with tree canopy can result in a bleached appearance and some distortion of young growth flushes.
Solicam 80DF Water ring treatment	F1	2.3 oz per 500 gal water. Apply 10 gal per tree assuming a ring diameter of 4 ft. Adjust rate according to ring diameter and amount of water. Apply prior to weed emergence. See product label for details. Apply at second or third watering--not during planting operation.	
Chemical injection through low volume sub-canopy irrigation systems		2-3 lb. Apply prior to weed emergence as supplemental treatment to herbicide strip. No treated area should receive more than 10 lb Solicam per acre per year from any combination of applications.	Solicam applied through irrigation systems will prolong weed control in areas influenced by emitters from which herbicides may have leached. Rate per acre should be based on measurement of area wetted by emitters and number of emitters per acre. See product label for calibration procedures. **CAUTION:** To be used only through irrigation systems which meet State requirements for chemical injection.

Table 1. Preemergence Soil Residual Herbicides

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
Oryzalin Oryzalin 4 AS Surflan 4 AS	K1	Do not exceed 1.5 gal per year. Apply prior to weed emergence as Surflan does not have postemergence activity. 0.5-1.5 gal of product per acre	Controls annual grasses and certain broadleaf weeds. Does not control perennial grasses or sedges. Spectrum of broadleaf weeds controlled is increased by tank mixing with simazine, diuron, or Krovar I. Will not control weeds that have germinated prior to application. Tank mixes with postemergence herbicides such as paraquat or glyphosate should be used to control existing weeds. One-half to 1-inch rainfall or sprinkler irrigation is required to activate oryzalin and move it into the zone of weed seed germination. Oryzalin will extend residual control of susceptible weeds when used in tank mixes with other products.
Chemical injection through low volume subcanopy irrigation systems		Apply prior to weed emergence as supplemental treatment to herbicide strip. No treated area should receive more than 1.5 gal per tree of oryzalin per acre per year from any combination of applications. See label for instructions for calculating product rates.	Oryzalin applied through irrigation systems will prolong weed control in areas influenced by emitters from which other herbicides have leached. Rate per acre should be based on measurement of area wetted by emitters and number of emitters per acre. See product label for further restrictions and for calibration procedures. **CAUTION:** To be used only through irrigation systems which meet State requirements for chemical injection.
Pendimethalin Pendimax Prowl (Nonbearing only)	K1	2.4-4.8 qt of product per acre Do not exceed 8 qt per acre per year.	Controls annual grasses. Does not control sedges. Spectrum of broadleaf weeds controlled is increased by tank mixing with diuron. Tank mixes with postemergence herbicides such as Gramoxone or glyphosate should be used to control existing weeds. Rain or irrigation is required within 21 days to move pendimethalin into the zone of weed seed germination.
Prowl H_2O		6.3-7.0 pt per acre Do not exceed 6.3 qt per acre per year.	
Simazine	C1	For application to oranges and grapefruit only. Do not exceed 8 lbs (active ingredient) per acre per year.	
Caliber 90WDG		4.4 lb (spring and/or fall) or a single application in the spring of 8.8 lb applied once per 12 months.	Controls annual broadleaf weeds, annual vines, and annual grasses. Does not control perennial grasses.

Table 1. Preemergence Soil Residual Herbicides

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
Princep 4L		1.0 gal of product (spring and/or fall) or a single application in the spring of 2.0 gal product per acre once per 12 months.	Higher single application rates are intended for difficult species such as balsamapple and spanish needles and for a spring application.
Simazine 4L		1.0 to 2.0 gal product. 2 gal per acre in spring (Ridge), 3.2 qt in bedded groves, apply only once per year.	Do not exceed 4 lb ai per treated acre per year on trees established for less than 1 year, and on sandy soils with low organic matter content or on poorly drained sites.
Simazine 90DF		4.4 lb (spring and/or fall) or a single application in the spring of 8.8 lb applied once per 12 months.	Apply only prior to weed emergence unless mixed with a postemergence contact or systemic herbicide. Has no contact activity. Avoid application during summer rainy period.

[1]Mode of action class for citrus pesticides from the Herbicide Resistance Action Committee (HRAC). Refer to ENY-624, Pesticide Resistance and Resistance Management, in the 2011 Florida Citrus Pest Management Guide for more details.

Table 2. Non-selective Postemergence Systemic Herbicides

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre in Acid Equivalent (A.E.); Time of Application[2]	Comments
Glyphosate - Undertree	G	Annual weeds: 0.75-1.5 lb A.E. per acre depending on stage of maturity. Perennial weeds: 1.5-3.75 lb A.E. per acre. Use higher rates for more difficult to control grasses, woody vines, and shrubs. Refer to product labels for annual maximum rate per acre.	Consult label rates for specific weed species. Some weeds require repeat application for control. Apply in (water volume of) 10-40 GPA. Glyphosate may be tank mixed with labeled residual herbicides. Water sources containing Ca, Mg, Fe, and Al at levels above 400 ppm may require the use of ammonium sulfate at a 1-2% solution (8.5 to 17 lb per 100 gal) for optimum activity. Rainfall within 1-6 hours after application may reduce effectiveness. **AVOID CONTACT WITH CITRUS FRUIT, FOLIAGE, AND GREEN BARK.** Application to early maturing varieties in late summer/ early fall may result in fruit drop when contacted by spray drift. Not all formulations of glyphosate contain surfactant. Addition of surfactant improves weed control if not present in original product.
Middles management			
Glyphosate - Chemical mowing	G	Bahiagrass 0.125 lb A.E. followed by a second application 45 days later Bermudagrass 0.125 - 0.37 lb A.E.	For suppression of grasses and broadleaf weeds in row middles for 45-90 days. Do not mow within 1 week before or after chemical mowing application.

Table 2. Non-selective Postemergence Systemic Herbicides

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre in Acid Equivalent (A.E.); Time of Application[2]	Comments
Glyphosate - Wiping	G	5-10% solution - carpet wiper 50-100% solution - panel wiper	Use wipers to remove tall growing and difficult to control weed species from desirable turf.
Glyphosate - Spot treatment	G	1-2% solution	**AVOID CONTACT WITH CITRUS FRUIT, FOLIAGE, AND GREEN BARK.**
Landmaster II	G, O	Annual weeds: 1-8 qt Perennial weeds: 4-8 qt Depending on weed species - see supplemental label for weeds controlled and recommended rates. Application with glyphosate will improve effectiveness. Maximum of 8 qt per year. Do apply within 7 days of harvest.	Applications should be applied with shielded boom with at least a 4-inch leading shielded edge and recessed boom with a back boom cover. Supplemental labeling must be in possession of the user at time of application. Do not apply in vicinity of 2,4-D sensitive crops such as tomatoes or other desirable vegetation. See label for minimum distance from susceptible crops and record keeping requirements including hourly wind speed, wind direction, location of application, amount used, etc. Applications should be made only when there is no hazard for spray drift. See label for additional restrictions. Rainfall or irrigation within 4 hours may reduce effectiveness. Sprayer cleanup: rinse entire system then add 1 qt ammonia per 25 gal water and allow to soak for 24 hours. Failure to clean tank may result in injury to desirable crops when subsequently sprayed.

[1]Mode of action class for citrus pesticides from the Herbicide Resistance Action Committee (HRAC). Refer to ENY-624, Pesticide Resistance and Resistance Management, in the 2011 Florida Citrus Pest Management Guide for more details.
[2]**NOTE** - Please see Table 3 for conversion of A.E. to amount of product to use to achieve desired weed control.

Table 3. Non-selective Postemergence Systemic Herbicides-Glyphosate Conversions.[1]

Acid Equivalence (A.E.) (lb/gal)	Rate per treated acre in A.E. (from Table 2)						
	0.094 lb	0.188 lb	0.282 lb	0.37 lb	0.75 lb	1.5 lb	2.25 lb
	Amount of product to equal the above pounds of A.E.						
3.0	4 oz	8 oz	12 oz	16 oz	1 qt	2 qt	3 qt
4.0	3 oz	6 oz	9 oz	12 oz	24 oz	48 oz	72 oz
4.5	2.7 oz	5.4 oz	8.1 oz	10.8 oz	21.5 oz	43 oz	64.5 oz
5.0	2.4 oz	4.8 oz	7.2 oz	9.5 oz	19.2 oz	38.4 oz	57.6 oz

[1]Various formulations of glyphosate are currently registered for use in Florida citrus.
It is important to adjust the application rate used according to the product concentration. A product concentration is stated in pounds per gallon of acid equivalent (A.E.) on the label.

Table 4. Non-selective Postemergence Contact Herbicides

Non-selective Postemergence Herbicide	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
Aim EC	E	Up to 2.0 fl oz of product per application and not to exceed 7.9 fl oz per year. Tank mix with other postemergence products increases weed spectrum controlled. Higher rates are needed when larger weeds are present.	An adjavant is required such as a nonionic surfactant or crop oil concentrate. Avoid contact with green tissue or fruit. Good coverage is essential for control. Apply in a finished spray volume of at least 20 gpa.
Paraquat Gramoxone Inteon	D	2.5-4.0 pt of product per acre. Do not apply in excess of 20 pt per acre per year. Apply as required alone or in combination with residual herbicides to control emerged weeds. Apply before weed growth becomes too dense as thorough spray coverage is required.	Controls all green weed tissue contacted. Rapid regrowth can be expected from perennial species. Addition of a surfactant is essential for maximum contact activity. **AVOID CONTACT WITH CITRUS FOLIAGE AND GREEN STEMS.**

[1]Mode of action class for citrus pesticides from the Herbicide Resistance Action Committee (HRAC). Refer to ENY-624, Pesticide Resistance and Resistance Management, in the 2011 Florida Citrus Pest Management Guide for more details.

Table 5. Selective Postemergence Systemic Herbicides

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
Fluazfop Fusilade DX 2 E (Nonbearing only)	A	1.0-1.5 pt of product per acre. Apply as needed to control emerged actively growing grasses. Repeat applications may be necessary to control many species. Plants are more susceptible in early stages of development rather than when mature (at seedhead formation).	Controls annual grasses and perennials such as bermuda, guinea, and torpedo. **Does not control broadleaf weed species.** Repeat applications (at 3-4 week intervals) will be required for guineagrass and torpedograss. Guineagrass should be treated when 6-12 inches tall. **Do not apply Fusilade to grasses under stress conditions.** Visible effects of herbicide activity on most grasses will be apparent in 2-3 weeks. If used according to label directions, Fusilade will not injure citrus. For spot treatment, use 1% v/v solution Fusilade with 1% crop oil concentrate or 0.25% nonionic surfactant in 30-40 gal per acre.
Sethoxydim Poast Plus 1.0 EC	A	2.25-3.75 pt of product per acre. Do not exceed 15 pt per acre per year. Apply as needed to control actively growing grasses. Repeat applications may be necessary for perennial species and guineagrass.	Controls annual and perennial grasses such as bermuda, guinea, and torpedo. **Does not control broadleaf weeds.** Repeat applications (at 3-4 week intervals) may be required for control of more troublesome species. It is advantageous to apply Poast Plus to grasses less than 12 inches in height. **Do not apply Poast Plus to grasses under stress conditions.** Visible effects will generally be observed within 2-3 weeks depending upon environmental conditions. Carrier volume should not exceed 20 GPA. For spot treatment use a 1.5-2.25% v/v solution of Poast Plus with 1% crop oil concentrate. If used according to label directions, Poast Plus will not injure citrus.

Table 5. Selective Postemergence Systemic Herbicides

[1]Mode of action class for citrus pesticides from the Herbicide Resistance Action Committee (HRAC). Refer to ENY-624, Pesticide Resistance and Resistance Management, in the 2011 Florida Citrus Pest Management Guide for more details.

Table 6. Herbicide Chemical Family

Herbicide Common Name	Chemical Family	HRAC MOA[1]	Weeds Controlled	
			Broadleaf	Grasses
Preemergence				
bromacil	uracil	C1		X
bromacil:diuron	uracil + urea	C1, C2	X	X
diuron	urea	C2	X	
norflurazon	pyridazinone	F1		X
oryzalin	dinitroaniline	K1		X
pendimethalin	dinitroaniline	K1		X
simazine	triazine	C1	X	
Post Emergence				
carfentrazone-ethyl	aryl triazinone	E	X	
fluazfop-P-butyl	aryloxyphenoxy propionate	A		X
glyphosate	glyphosate	G	X	X
glyphosate + 2,4-D	glyphosate + phenoxy	G, O	X	X
paraquat	paraquat dichloride salt	D	X	X
sethoxydim	cyclohexanedione	A		X

[1]Mode of action class for citrus pesticides from the Herbicide Resistance Action Committee (HRAC). Refer to ENY-624, Pesticide Resistance and Resistance Management, in the 2011 Florida Citrus Pest Management Guide for more details.

Table 7. Recommended Chemical Controls for Citrus Root Sprouts

Herbicide/Chemical	Application	Comments
Glyphosate (check specific product labels)	Apply in 50 to 100% solution to freshly-cut surface immediately after cutting to cover the entire cambium layer of the stump. Delays in application may result in reduced performance.	Do not make stump application when roots of desirable trees may be grafted to the roots of the cut stump. Injury may result from root grafting in adjacent trees allowing materials to move systemically into the nearby tree. **NOTE:** Not all glyphosate products contain a statement for stump treatments.
Remedy Ultra	Apply as a 25% solution in diesel, kerosene or quality basal oil (1 qt in 3 qt oil). Apply spray mixture directly to cut stump and avoid applications that allow spray solution to contact soil surface adjacent to the cut stump.	Applications to the soil adjacent to cut stump may injury newly transplanted trees. Do not replant within 30 days of treatment. Do not make stump applications when the roots of adjacent desirable trees may be grafted to the roots of cut stump. Injury or symptoms resulting from root grafting may occur in adjacent trees. Avoid application methods that would allow spray drift to occur.