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2024–2025 Florida Citrus Production 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 of 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 on the citrus tree, be it 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 neither necessary nor warranted.

When developing a weed management program, growers must consider the (1) application site (tree age, soil type, and location, including ridge vs. flatwoods and county limitations); (2) weeds present; (3) stage of weed growth; (4) herbicide selection; (5) spray nozzle and herbicide bandwidth; (6) spray volume and pressure; and (7) amount of herbicide used. All 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 trees 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 as compared to mature trees.

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 given to product selection based upon variety. Some products specify that they may only be used on oranges, thus prohibiting their use on tangerines.

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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, sandblasting during windy conditions, and retaining nutrients, but it can also impact tree growth when allowed to compete with the citrus tree. Sod-forming bahiagrass and bermudagrass are typically used as ground cover between the tree rows, but bermudagrass can be more competitive than bahiagrass. Ground cover can be beneficial if it is less competitive than any 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 containing 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 through 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. Because 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, because 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, and 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 publications: HS-926/HS185, "Identification of Vine Weeds in Florida Citrus"; HS-896/HS150, "Identification of Broadleaf Weeds in Citrus"; HS-955/HS175, "Identification of Grass Weeds in Florida Citrus"; and HS-962/HS205, "Identification of Sedge and Sedge-Like Weeds in Florida Citrus".

Weed Management Options

Many approaches are used to suppress 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 programs entail the use of such practices as sanitation, spot spraying, or hand labor to prevent the source of weed infestation (seed or vegetative) from widespread dissemination throughout an area. By removing the undesirable weed species prior to seed development, dissemination by the 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 by severing stems and roots of the weeds, but it is 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 damages the fibrous roots close to the soil surface, which is the main reason for the 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 tables, 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 or mechanical mowing is dependent on the weeds present and the season.

Chemical

Chemical weed-control programs will vary from location to location within the state and can even vary within a given site based on 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 or through 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 that 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 trees) 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 or regrowth of grasses and broadleaf weeds that grow in the row middle for up to 45–90 days. Prior to the chemical mowing application, the vegetation within the row middle is mowed and allowed to slightly regrow.

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 application. Remember that 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 that stress plants, including drought, flooding, and extreme temperatures, could result in reduced herbicide performance. Stressed plants take up and translocate less herbicide than nonstressed plants. Poor herbicide performance is minimized when the proper herbicide is selected and applied at recommended rates in the correct spray volume 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). Other herbicides can be applied directly to weeds and are referred to as 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.

Additional consideration should be given to products containing bromacil, which are prohibited on deep, sandy, ridge-type soils. Also, some product labels restrict the annual application of diuron within Highlands County. Please consult your local UF/IFAS Extension 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 an herbicide boom, complete uniform coverage of the soil surface is important for improved weed control. Factors that can affect the 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. Weeds present will also affect spray patterns as well as block 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 that minimize material drift or potential contact with tree foliage.

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

Additional information about herbicide equipment and its calibration can be found in EDIS publication HS-1012/HS252, "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.

Position of the Off-Center Nozzle on the Herbicide Boom

Herbicide applicators should think about the angle of the off-center (OC) nozzle on the end of the herbicide boom. The nozzle angle will have a major impact on where the spray is directed upward as well as the distance from the end of the boom. The greater the nozzle angle, the higher and farther beyond the end of the boom the spray is directed, greatly increasing the chances of phytotoxicity occurring in the tree canopy. The height of the boom and its angle will also impact the distance and height that the spray is directed into the canopy of the citrus tree.

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 herbicide, the risk of 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 for development of herbicide resistance. A listing of the recommended herbicides is 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 products to be used 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 that minimizes the 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 because 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 the adjacent tree(s).

Be sure to read and follow all label requirements.

Web Addresses for Links

EDIS Publication HS-926/HS185, "Identification of Vine Weeds in Florida Citrus": https://doi.org/10.32473/edis-hs185-2003

EDIS Publication HS-896/HS150, "Identification of Broadleaf Weeds in Citrus": https://doi.org/10.32473/edis-hs150-2003

EDIS Publication HS-955/HS175, "Identification of Grass Weeds in Florida Citrus": https://doi.org/10.32473/edis-hs175-2004

EDIS Publication HS-962/HS205, "Identification of Sedge and Sedge-Like Weeds in Florida Citrus": https://doi.org/10.32473/edis-hs205-2004

EDIS publication HS-1012/HS252, "Citrus Herbicide Boom Sprayer Calibration": https://doi.org/10.32473/edis-hs252-2005

Recommended Chemical Controls

Table 1. Preemergence soil residual herbicides.

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
Indaziflam Alion	L – Cellulose-biosynthesis inhibitor	5 to 6.5 oz/ac. Do not exceed 10.3 oz/ac per 12-month period.	Preemergence control of seed-germinating grass and broadleaf weeds. A postemergence herbicide should be tank mixed to control weeds that have already emerged at the time of application. Best control is achieved when minimal weed debris is present on the soil surface at application. Avoid direct or indirect spray contact with foliage, because it may cause localized chlorotic speckling. Do not apply Alion within 30 days prior to planting or within 30 days after planting citrus trees. For repeat application, allow a minimum of 90 days between applications.
Bromacil Hyvar X 80 WP	C1	Ridge: Do not use on vulnerable, deep-sandy, ridge soil types. See product label under general precautions and use restrictions for specific soil series. Flatwoods: Do not exceed a total of 6 lb/acre per year.	Controls annual and perennial grasses and annual broadleaf weeds. Postemergence activity, particularly with a surfactant.
Trees 4 years and older		2–4 lb. 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. Use lower recommended rates on lighter soils 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 soil types. See supplemental product label for further details. Flatwoods: Do not exceed 12 lb/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 the surfactant.
Trees 3 years and older		4–6 lb/acre. Apply prior to weed emergence or early postemergence.	
Trees established 1–3 years		2–4 lb/acre. Do not exceed 8 lb per year. Use lower rates on lighter soils or in low weed-infestation areas.	
Flumioxazin Chateau EZ	E	6–12 oz/ac. Maximum rate of 24 oz/ac per 12-month period. Do not make a sequential application within 30 days of the first application.	Application should be made to weed-free soil surface. Residual weed control will be reduced if vegetation prevents herbicide from reaching the soil surface. When weeds are present, application must be mixed with a labeled surfactant and burndown product. Do not apply to trees less than 1 year old unless protected from spray contact by non-porous wrap. Rainfall or irrigation of at least ¼ inch is required to activate the herbicide into soil for weed control.

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
Diuron	C2		Do not exceed 8 lb a.i./acre per year on flatwoods soils. Do not exceed 6.4 lb a.i./acre per year on ridge soils. In Highlands County, do not exceed 4.8 lb a.i./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.
Diuron 80DF Direx/Diuron 4L Karmex 80DF		2–4 lb product 1.6–3.2 qt 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. Certain grapefruit varieties, like 'Flame', are relatively more sensitive to this herbicide.
Norflurazon Solicam 80DF	F1	2.5–5 lb/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/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 the planting operation.	
Chemical injection through low-volume subcanopy irrigation systems		2–3 lb. Apply prior to weed emergence as a supplemental treatment to herbicide strip. No treated area should receive more than 10 lb/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 that meet state requirements for chemical injection.
Oryzalin Oryzalin 4 AS Surflan 4 AS	K1	Do not exceed 1.5 gal per year. Apply prior to weed emergence; Surflan does not have postemergence activity. 0.5–1.5 lb/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. 1/2 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.

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
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 that meet state requirements for chemical injection.
Pendimethalin Prowl 3.3EC (Nonbearing only)	K1	2.4–4.8 qt/acre. Do not exceed 7.3 qt/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 paraquat 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_20		2.1–6.3 pt/acre. Do not exceed 6.3 qt/acre per year.	
Simazine	C1	For application to oranges and grapefruit only. Do not exceed 8 lb a.i./acre per year.	
Caliber 90WDG		4.4 lb (spring and/or fall) or a single application of 8.8 lb in the spring applied once per 12 months.	Controls annual broadleaf weeds, annual vines, and annual grasses. Does not control perennial grasses.
Princep 4L		1.0 gal (spring and/or fall) or a single application of 2.0 gal/acre in the spring once per 12 months.	Higher single application rates are intended for difficult species, such as balsam-apple and Spanish needles, and for a spring application. Do not exceed 4 lb a.i. per treated acre per year on trees established for less than 1 year, on sandy soils with low organic matter content, or on poorly drained sites. 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.
Simazine 4L		1.0 to 2.0 gal product. 2 gal/acre in spring (ridge), 3.2 qt in bedded groves; apply only once per year.	
Simazine 90DF		4.4 lb (spring and/or fall) or a single application of 8.8 lb in the spring applied once per 12 months.	

[1] Mode of action class for citrus pesticides from the Herbicide Resistance Action Committee (HRAC). Refer to chapter 4, "Pesticide Resistance and Resistance Management".

Table 2. Nonselective 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./acre, depending on stage of maturity. Perennial weeds: 1.5–3.75 lb A.E./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.
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 Dependent on weed species—see supplemental label for weeds controlled and recommended rates. Application of glyphosate will improve effectiveness. Maximum of 8 qt per year. Do not 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 the 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 recordkeeping 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.
Middles Management			
Glyphosate—chemical mowing	G	Bahia grass: 0.125 lb A.E. followed by a second application 45 days later. Bermuda grass: 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.
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.

[1] Mode of action class for citrus pesticides from the Herbicide Resistance Action Committee (HRAC). Refer to chapter 4, "Pesticide Resistance and Resistance Management".
[2] NOTE—Please see Table 3 for conversion of A.E. to amount of product to use to achieve desired weed control.

Table 3. Nonselective postemergence systemic herbicide-glyphosate conversions.

Product[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. Nonselective postemergence contact herbicides.

Nonselective Postemergence Herbicide	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
Carfentrazone-ethyl Aim 2 EC	E	Up to 2.0 fl oz per application and not to exceed 7.9 fl oz per year. Tank-mixing with other postemergence products increases weed spectrum controlled. Higher rates are needed when larger weeds are present.	An adjuvant, such as a nonionic surfactant or crop oil concentrate, is required. Avoid contact with green tissue or fruit. Good coverage is essential for control. Apply in a finished spray volume of at least 20 GPA. Do not make applications less than 14 days apart.
Glufosinate-ammonium Rely 280 Scout	H	48–82 fl oz/acre per application with higher rates on taller, susceptible weeds. Do not apply more than 246 fl oz (4.5 lb a.i./ac) per year. Do not make more than 3 applications at maximum rate per year. Do not apply within 14 days of harvest.	For best results, apply to emerged, young, actively growing weeds. Warm temperatures, high humidity, and bright sunlight improve the performance. Avoid application to weeds under stress. Avoid application during conditions where temperature inversions that would favor drift are likely. Avoid contact or spray drift with green bark, stems, or foliage, because injury may occur. Young trees with green stems should have a nonporous wrap in place to avoid contact with susceptible tissue. Follow-up applications must be a minimum of 14 days apart.
Paraquat Gramoxone SL 2.0	D	2.5–4.0 pt/acre. Do not apply in excess of 20 pt/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. New labeling requirements require mandatory training program be completed by all applicators, and all applicators must be certified applicators of restricted use pesticides. Addition of a surfactant is essential for maximum contact activity. **AVOID CONTACT WITH CITRUS FOLIAGE, GREEN STEMS, AND FRUITS.** Maximum of five applications per year.

[1] Mode of action class for citrus pesticides from the Herbicide Resistance Action Committee (HRAC). Refer to chapter 4, "Pesticide Resistance and Resistance Management".

Table 5. Selective postemergence systemic herbicides.

Herbicide Name	HRAC MOA[1]	Rate per Treated Acre; Time of Application	Comments
Fluazifop-P-butyl Fusilade DX 2 EC	A	Do not apply more than 24 oz/acre per application and not more than 72 fl oz/acre per year, with a minimum of 21 days between applications. 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 guinea grass and torpedograss. Guinea grass should be treated when 6–12 inches tall. **Do not apply Fusilade to grasses under stressed 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 GPA.
Mesotrione Broadworks 4 L	F2	Do not exceed 6 fl oz/ac at the first application. Do not exceed 12 fl oz/ac or more than 3 applications within a 12-month period. Allow at least 12 weeks between two subsequent applications of 6 fl oz/ac each, and at least 6 weeks between one application of 6 fl oz/ac and one or two subsequent applications of 3 fl oz/ac.	The use of a crop oil concentrate at 1% v/v or nonionic surfactant at 0.25% v/v is recommended. The addition of ammonium sulfate is suggested. Provides short-term residual weed control, and can be tank mixed with nonselective postemergence products to broaden the weed control spectrum, or with several preemergence products to lengthen residual weed control. Consult the label for allowable tank-mix partners.
Sethoxydim Poast Plus 1.0 EC	A	2.25–3.75 pt/acre. Do not exceed 15 pt/acre per year. Apply as needed to control actively growing grasses. Repeat applications may be necessary for perennial species and guinea grass.	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.
Saflufenacil Treevix	E	1.0 oz per treated acre as a postemergence-directed spray application. For optimum burndown activity, an adjuvant such as methylated seed oil must be used and should be combined with ammonium sulfate.	Controls many broadleaf weeds. **Does not control grass weeds.** Thorough spray coverage is required for control of emerged broadleaf weeds. Avoid contact with tree trunks, especially young trees, until bark is fully formed. Do not exceed 3 applications per year and applications must be separated by 21 days. Increased efficacy has been observed at spray volumes of 20 to 40 GPA.
2,4-D Embed Extra	O	1.0–4.0 pt per treated acre as a postemergence-directed spray application. **The application should be made only when there is no hazard from spray drift.**	Controls annual and perennial broadleaf weeds. Use coarse, low-pressure sprays and sufficient water for thorough coverage of weeds. Apply when weeds are small and actively growing. Apply only to groves that have been established for at least 1 year. **Avoid contact with tree trunks and foliage.**

[1] Mode of action class for citrus pesticides from the Herbicide Resistance Action Committee (HRAC). Refer to chapter 4, "Pesticide Resistance and Resistance Management".

Table 6. Herbicide chemical family.

Herbicide Common Name	Chemical Family	HRAC MOA[1]	Weeds Controlled	
			Broadleaf	Grasses
Preemergence				
bromacil	uracils	C1		X
bromacil:diuron	uracils + ureas	C1, C2	X	X
diuron	ureas	C2	X	
flumioxazin	N-phenyl-imides	E	X	X
indaziflam	alkylazines	L2	X	X
norflurazon	pyridazinones	F1	X	X
oryzalin	dinitroanilines	K1		X
pendimethalin	dinitroanilines	K1		X
simazine	triazines	C1	X	X
Postemergence				
2,4-D	phenoxy-carboxylates	O	X	
carfentrazone-ethyl	N-phenyl-triazolinones	E	X	
fluazifop-P-butyl	aryloxyphenoxy-propionates	A		X
glufosinate	phosphinic acid	H	X	X
glyphosate	glycine	G	X	X
glyphosate + 2,4-D	glycine + phenoxy-carboxylates	G, O	X	X
mesotrione	triketones	F2	X	
paraquat	pyridiniums	D	X	X
saflufenacil	uracils	E	X	
sethoxydim	cyclohexanediones	A		X

[1] Mode of action class for citrus pesticides from the Herbicide Resistance Action Committee (HRAC). Refer to chapter 4, "Pesticide Resistance and Resistance Management".
[2] Cellulose-biosynthesis inhibitor.

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 injure 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.