

Chapter 22.

Sweetpotato Production in Florida

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BOTANY

Nomenclature

Family - Convolvulaceae

Sweetpotato - *Ipomoea batatas*

Origin

Originating in tropical America, the sweetpotato was cultivated by pre-Inca farmers.

Related species

Water convolvulus, water spinach, and kangkong (*Ipomoea aquatica*), both upland and aquatic types, are grown as leafy vegetables in the tropics. This crop is illegal in Florida due to the noxious weed potential in fresh waterways. The tops of sweetpotato, especially varieties with short internodes, are sometimes used as a substitute for water convolvulus.

VARIETIES

Sweetpotato varieties grown in Florida include:

Beauregard

Covington

Hernandez

Jewel

Picadito (Boniato)

PLANTING AND SEEDING

Planting dates and seeding information for sweet potato are given in Table 1.

FERTILIZER AND LIME

Broadcast all P_2O_5 , micronutrients, and 25 to 50% of N and K_2O before planting. Better fertilizer efficiency might result by banding P_2O_5 and micronutrients when beds are made. Sidedress remaining N and K_2O by banding in side of bed in one or two applications before vines cover sides of beds. Soil test and fertilizer recommendations for sweetpotato on mineral soils are given in Table 2.

PLANT TISSUE ANALYSIS

Plant tissue analysis information for sweetpotato is given in Table 3. The analysis was done before initiation of root enlargement, using the most recently matured leaf.

IRRIGATION

Sweetpotato water requirements (see Chapter 3, *Principles and Practices for Irrigation Management of Vegetables*, Table 4 to 6) increase from 20% of ETo during early growth to 60% of ETo during rapid growth and root enlargement (see Chapter 3, *Principles and Practices for Irrigation Management of Vegetables* Table 3). Proper water management is essential for optimum root sizing.

Water requirements and subsequent irrigation requirements may be reduced to 70% of ETo during the last few weeks of growth.

Table 1. Planting information for sweetpotato.

Planting dates

North Florida	Mar - June
Central Florida	Feb - June
South Florida	Dec - Sept (orange fleshed types) Year-round (boniato/batatas types)

Planting information

Distance between rows (in)	36 - 48
Distance between plants (in)	10 - 12
Planting depth (in)	3 - 4
Transplants needed per acre	9,000 - 15,000
Days to maturity from transplant	85 - 130
Plant populations (acre)	9,000 - 15,000

Table 2. Soil test and fertilizer recommendations for mineral soils for sweetpotato (beds on 36 to 42 inch centers).¹

Target pH	N lb/A ²	VL L M H P ₂ O ₅ ² VH				VL L M H K ₂ O VH					
		VL	L	M	H	VH	VL	L	M	H	VH
6.5	60	120	100	80	0	0	120	100	80	0	0

¹ See Chapter 2 section on supplemental fertilizer application and best management practices, pg 11.² Seeds and transplants may benefit from applications of a starter solution at a rate no greater than 10 to 15 lbs/acre for N and P₂O₅, and applied through the plant hole or near the seeds.**Table 3.** Plant tissue analysis for sweetpotato just before roots begin to enlarge. Dry wt. basis.

Status	N	P	K	Ca	Mg	S	Fe	Mn	Zn	B	Cu
	Percent						Parts per million				
Deficient	<3.0	0.2	2.0	0.5	0.25	0.2	40	40	25	25	5
Adequate range	3.0 - 4.0	0.2 - 0.3	2.0 - 4.0	0.5 - 1.8	0.25 - 0.5	0.2 - 0.4	40 - 100	40 - 100	25 - 40	25 - 40	5 - 10
High	>4.0	0.3	4.0	1.8	0.5	0.4	100	100	40	40	10

Table 4. Chemical weed control in sweetpotato.

Active Ingredient lb. a.i. / Acre	Trade name Product / Acre	Weeds controlled & remarks
***PREPLANT ***		
Carfentrazone up to 0.031	(Aim) 2 EC or 1.9 EW up to 2 fl. oz.	Emerged broadleaf weeds. Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate or nonionic surfactant at recommended rates. May be tank mixed with other herbicides.
Clomazone 0.49 – 0.75	(Command) 3 ME 1.3 – 2.0 pt.	Annual broadleaf and grass weeds. Use lower rates on coarse soils. Apply within 5 days of transplanting.
DCPA 4.5 - 6	(Dacthal) W-75 6 – 8 lb. (Dacthal) 6 F 6 – 8 pt.	Annual broadleaf and grass weeds. Apply immediately after transplanting. May be applied as a layby later in the season for preemergence control.
Flumioxazin 0.096	(Valor) 51 WDG 3 oz.	Annual broadleaf weeds. Do not use on sweetpotato varieties other than "Beauregard" unless user has tested other varieties and found crop tolerance. Apply 2 – 5 days before transplant and minimize soil disturbance after application.
Glyphosate	Various formulations consult labels	Emerged broadleaf and grass weeds. Apply as a preplant burn down. Consult label for individual product directions.
Napropamide 1.0 – 2.0	(Devrinol) 50 DF 2 - 4 lb.	Annual broadleaf and grass weeds. Apply immediately after transplanting. If rainfall does not occur within 24 hours after application then incorporate or irrigate 2 to 4 inches deep.
Pelargonic acid	(Scythe) 4.2 EC 3 – 10%	Emerged broadleaf and grass weeds. Apply as a preplant burn down treatment. Product is a contact, nonselective, foliar applied herbicide with no residual control. May be tank mixed with soil residual compounds.

Table 4. Continued.

Active Ingredient lb. a.i. / Acre	Trade name Product / Acre	Weeds controlled & remarks
POSTEMERGENCE		
Carfentrazone up to 0.031	(Aim) 2 EC or 1.9 EW up to 2 oz.	Emerged broadleaf weeds. Apply as hooded application to row middles only. Use crop oil concentrate or nonionic surfactant at recommended rates. Contact with the leaves will cause injury. PHI 0 days.
Clethodim 0.09 – 0.25 0.07 - 0.25	(Select, Arrow) 2 EC 6 – 16 fl. oz.	Perennial and annual grass weeds. Use higher rates under heavy grass pressure or larger grass weeds. Do not apply more than 0.5 lb. ai./A. Use a crop oil concentrate at 1% v/v in the finished spray solution. Select Max requires a NIS at 0.25% v/v. PHI 30 days.
	(Select Max) 1 EC 9 - 32 fl. oz	
Fluazifop 0.1 to 0.25	(Fusilade DX) 2 EC 6 – 16 fl. oz.	Perennial and annual grass weeds. Include a NIS at 0.25 – 0.5% v/v or COC at 0.5 – 1.0% v/v in the spray solution. PHI 55 days.
Pelargonic acid	(Scythe) 4.2 EC 3 – 10%	Emerged broadleaf and grass weeds. Apply as a hooded application to row middles only. Contact with the leaves will cause injury.
Sethoxydim 0.19 – 0.47	(Poast) 1.5 EC 1.0 to 2.5 pt.	Controls growing grass weeds. A total of 5.0 pt. /A applied in one season. Include a crop oil concentrate. Unsatisfactory results may occur if applied to grasses under stress. PHI 30 days.

CULTURAL PRACTICES

Soil Preparation

Sweetpotatoes grow best when the soil is turned 2 to 3 months before planting. Plowing early helps rot plant debris and reduce some nematode and disease problems. Soils in Miami-Dade County (except for marl soils) should be scarified or “rock plowed” prior to planting to improve drainage and increase available soil depth.

Deep, sandy soils will always produce the best shaped and best looking sweetpotatoes. However, long periods of dry weather during the growing season reduce yields if supplemental irrigation cannot be supplied. Wet weather for extended periods can cause leaching of N and K, requiring the addition of more fertilizer than on heavier soils. More frequent applications of lesser amounts of fertilizer are suggested for coarse textured soils.

Soils with more than 2% organic matter are not well suited to sweetpotato production since they usually produce a large percentage of rough or cracked storage roots. Scurf and black rot fungi are more persistent in these soils than in those with less organic matter.

In general, fields that have not been used for sweetpotatoes in the last 2 to 3 years are preferred. Avoid fields that have been idle or have very high nematode populations.

Bedding

Plants are often established in rows on flat land (Fig. 22-3). During the cultivation process, ridges are formed down the rows of plants. However, beds can be formed

ahead of time, especially when preplant fertilizers or pest control chemicals need to be applied to the soil before planting. Vines take root at all locations where vines are covered, providing additional sites for storage root formation. In locations where sweetpotato weevils are present, keeping the storage roots covered with soil helps to minimize damage. Ridges also improve drainage and facilitate harvesting.

Cover Crops

Cover crops are not recommended immediately after sweetpotato production. Cultivation is needed after harvest to prevent feral plant establishment.

WEED MANAGEMENT

Herbicides labeled for weed control in sweet potato are listed in Table 4.

DISEASE MANAGEMENT

Virus diseases are the major group of pathogens affecting sweetpotatoes, though many do not cause problems in the United States. Feathery mottle virus is the most common in the U.S. Losses due to infection are as much as 50% with incidences of single and multiple infections approaching 100% in a field. Since sweetpotatoes are vegetatively propagated, virus diseases can be carried from one planting to another in the propagules. Genetic resistance to sweet potato viruses is not well documented.

Common fungal and bacterial diseases of sweetpotatoes in the U. S. include: bacterial wilt and root rot, black rot, internal cork, pox or soil rot, rhizopus soft rot, scurf, surface rot, circular spot, and wilt (stem rot).

Effective disease control for sweetpotatoes is based on prevention. Most of the important diseases are caused by root pathogens or are capable of spreading systemically through the plant. It is generally not possible to restore the health of an affected plant once the disease can be detected. Since sweetpotatoes are vegetatively propagated, pathogens are easily transmitted in the planting stock. A crop rotation of at least 3 years is an important means of controlling diseases. Table 5 outlines the chemicals approved for disease management in sweetpotatoes and yams.

Physiological Disorders

Hardcore and internal breakdown are the main physiological disorders affecting sweetpotatoes.

Harvesting/Packing/Shipping

Unlike most vegetable crops, sweetpotatoes do not have a definite stage where they are classified as mature since plants will continue to grow as long as there are green leaves. The crop should be harvested when it has produced the highest percentage of roots of the desired size. Sweetpotatoes should be harvested before killing frosts. Partial or complete freezing of the foliage is not likely to damage the crop unless soil temperature around the roots is less than 55°F for several hours. Because of the sweet potato weevil, Florida is a quarantine state and potatoes may not be shipped through any of the southeastern states that grow sweetpotatoes.

NEMATODE MANAGEMENT

Sweetpotatoes are frequently damaged by root-knot and reniform nematodes. Either may cause stunting and yield loss; root-knot nematodes in the tubers may cause cracking or internal dark lesions which severely reduce the value of the product. Several steps should be taken together to minimize nematode injury to sweetpotatoes. These include crop rotation; varietal resistance; nematode-free transplants; and nematicides.

Crop Rotation

There are usually not as many root-knot or reniform nematodes where the preceding crop was a grass or small grain. Most vegetable crops are among the worst crops to precede sweetpotatoes, from the standpoint of building up hazardous nematode populations. Field corn may be better than most vegetables. Do not plant sweetpotatoes in the same field in successive years.

NEMATODE-FREE TRANSPLANTS

Do not take nematodes or other soil-borne problems to the field by planting contaminated plants. If plants must be propagated from suspect soil, use un-rooted cuttings to avoid carrying potential problems into the field.

Nematicides

Where damaging levels of nematodes exist, the nematicides listed in Table 6 should reduce losses if applied as directed.

Before application of a nematicide, carefully read and follow the label.

INSECT MANAGEMENT

Weevils are the main pest of sweetpotato. In the United States, the sweetpotato weevil is of major concern. Larvae are reared primarily in storage roots and can be transported from one location to another, unnoticed. Their damage to storage roots makes them unmarketable.

Resistance is not well-documented. Selecting pest-free propagules for planting is one method of control and minimizing adult weevil access to storageroots by keeping them well-covered with soil is another. Keeping fallowed fields free of feral plants and maintaining good sanitation in packing and storage buildings is also recommended.

Other pests identified in the U.S. include: southern potato wireworm, the tobacco wireworm, the banded cucumber beetle, the spotted cucumber beetle, the elongate flea beetle, the pale-striped flea beetle, white grub, and sweetpotato flea beetle. Such findings are similar to those of the other root and tuber crops, once production has become extensive in a particular region and scientific attention is available to investigate pest problems. Fortunately, good levels of genetic resistance are available for these insect groups. To supplement this resistance, various chemical pesticides can be used for insect control in sweetpotatoes. These are listed in Table 7.

Table 5. Sweet Potato fungicides and other disease management products.

Fungicide Group	Chemical	Max. Rate / Acre		Min. Days to		Pertinent Diseases or Pathogens	Remarks
		Applic.	Season	Harvest	Reentry		
M2	Micro Sulf (sulfur)	5 lb/treated acre	-	0	1	Septoria leaf spot	Do not use within 2 weeks of an oil spray treatment
M2	Microthiol Disperss (sulfur)	10 lb	-		1	Leaf spot, powdery mildew	Do not use within 2 weeks of an oil spray treatment
1	Mertect 340-F (thiabendazole)	107 fl oz/100 gal water	-	0	0.5	Black rot, Scurf, Root rot	Dip seed roots for 1-2 min
4	Allegiance FL (metalaxyl)	0.75 fl oz/100 lb. seed	-	-	1	Pythium damping-off	Seed treatment
4	Apron XL (mefenoxam)	0.64 fl oz/100 lb seed	-	0	2	Pythium damping-off	See label
4	Metestar 2E AG (metalaxyl)	See label	-	14	2	Phytophthora, Pythium root rot	See label
4	Ridomil Gold EC Ridomil Gold SL (mefenoxam)	2 pt/treated acre	-	0	2	Pythium, Phytophthora root rot	Apply in water or liquid fertilizer & incorporate into top 2 inches of soil
4	Sebring 2.65 ST (metalaxyl)	0.75-1.5 fl oz per 100 lb of seed	-	-	1	Pythium, Phytophthora spp.	Seed treatment. See label
4	Ultra Flourish (mefenoxam)	4 pt	-	0	2	Pythium, Phytophthora root rot	Apply as a broadcast soil application at preplant or as a surface application at planting
7	Endura (boscalid)	10 oz	20 oz	10	0.5	Sclerotinia white mold	See label
9	Scala SC (pyrimethanil)	7 fl oz	35 fl oz	7	0.5	Early blight, Botrytis leaf spot	See label
9 & 12	Switch 62.5WG (cyprodinil; fludioxonil)	14 oz	56 oz	7	0.5	Alternaria leaf blight, Powdery mildew	Alternate with another labeled fungicide for 2 applications after 2 applications of Switch WG
11	Aftershock Evito 480SC (fluxostrobin)	3.8 fl oz	22.8 fl oz	7	0.5	Alternaria, Phytophthora	Limit to 6 applications per season
11	Cabrio EG (pyraclostrobin)	16 oz 5.73 oz/14 gal water per 1000 sq ft of plant bed 0.6 qt/100 gal for spray and root dip	48 oz - -	0	0.5	White rust (<i>Albugo</i> spp.) Sclerotinia blight Rhizopus Rot	Alternate with other labeled fungicides after each application Spray See label
11	Headline (pyraclostrobin)	12 oz treated acre	1.18 lb/treated acre	3	0.5	Various See label	See label
11	Heritage (azoxystrobin)	10.5 oz/treated acre	2 lb/treated acre	0	4 hrs	Diseases including Alternaria leaf spot See label	Do not apply directly to water except as specified on the label
11	Quadris (azoxystrobin)	Various, See label	Various, See label	See label	4 hrs	Various soil-borne diseases. See label	See label

Table 5. Continued.

Fungicide Group	Chemical	Max. Rate / Acre		Min. Days to Harvest		Pertinent Diseases or Pathogens	Remarks
		Applic.	Season	Harvest	Reentry		
11	Reason 500SC (fenamidone)	8.2 fl oz	16.4 fl oz	14		Alternaria blight, White rust	Do not make more than 1 application before alternating with a registered fungicide having a different mode of action
11 & 3	Quadris TOP (azoxystrobin; difenoconazole)	14 fl oz	55.3 fl oz	14	0.5	Alternaria blight, Powdery mildew, Septoria leaf spot, Rust	Make no more than 2 consecutive applications; Adding adjuvant may enhance the efficacy
12	Maxim 4FS (fludioxonil)	0.16 fl oz/100 lb seed		0	0.5	Seed decay, damping-off, seedling blight caused by soil pathogens	Not effective against <i>Pythium</i> spp.; Tank mix with others for <i>Pythium</i> control
12	Scholar Fungicide (fludioxonil)	8-16 oz in 100 gal of water for post-harvest dip applications; 8 oz in 7-25 gal of water for low volume applications		0	0.5	Post-harvest rot caused by <i>Rhizopus stolonifer</i>	Post-harvest treatment; Do not make more than 1 post-harvest application
12	Scholar SC (fludioxonil)	In-line dip/drench, 16-32 fl oz/100 gal of water In-line aqueous or fruit coating spray application, 16 fl oz/200,000 lb of sweet potatoes					
33	Phorcephite (potassium phosphite)	4 qt		0	4 hrs	<i>Pythium</i> , <i>Phytophthora</i> spp. and others. See label	Limit to 6 applications
33	Rampart (potassium phosphite)	See label		0	4 hrs	Pink rot, Late blight <i>Pythium</i> , <i>Phytophthora</i> spp. and others	See label
33	Allude (potassium phosphite)	1.25 qt		0	4 hrs	Pink rot, Pythium leak	See label
33	Fosphite fungicide (potassium phosphite)	See label		0	4 hrs	Control many diseases See label	Do not apply foliarly to plants treated with copper based compounds at less than 20 day intervals unless instructed to do so
33	Fungi-Phite (potassium phosphite)	Various, See label		0	4 hrs	<i>Pythium</i> , <i>Phytophthora</i> root rot	See label

Table 5. Continued.

Fungicide Group	Chemical	Max. Rate / Acre		Min. Days to Harvest		Pertinent Diseases or Pathogens	Remarks
		Applic.	Season	Reentry			
40	Revus (mandipropamid)	5.5-8 fl oz	32 fl oz	14	4 hrs	Phytophthora spp.	Make no more than 2 consecutive applications; adding adjuvant is recommended.
43	Presidio Fungicide (fluopicolide)	4 fl oz		7	0.5	Pink rot, Late blight	For resistance management, tank mix with a labeled fungicide having a different mode of action
44	Cease (Bacillus subtilis strain QST 713)	6 qt		0	4 hrs	Black root/crown rot	See label
44	Rhapsody (Bacillus subtilis strain QST 713)	6 qt		0	4 hrs	Black root/crown rot, Early blight	Refer to label
P	Regalia (extract of Reynoutria sachalinensis)	4 pt		0	4 hrs	Powdery mildew, Gray mold, Early blight, Black root/crown rot	Tank mix with other registered fungicides when disease pressure is high
NC	Armicarb 100 Fungicide (potassium bicarbonate)	5 oz/100 gal water		0	4 hrs	Alternaria, Septoria leaf spot, Botrytis gray mold	See label
NC	Milstop (potassium bicarbonate)	5 lb		0	1 hr	Botrytis gray mold, Penicillium spp., Powdery mildew, Septoria leaf spot	See label
NC	Sonata (Bacillus pumilus strain QST 2808)	4 qt		0	4 hrs	Early blight, Powdery mildew, White mold	Can be used alone or in alternating spray programs or tank mixes
NC	Sporatec (rosemary oil, clove oil, thyme oil)	2.0 pt		0	0	Black root rot, Early blight, Powdery mildew	Use of a spreader and/or penetrating adjuvant improves product performance
NC	Tenet WP (Trichoderma asperellum ICC 012, Trichodema gamsii ICC 080)	Various rates (See label)		0	1 hr	Various soil pathogens	See label
NC	Trilogy (neem oil)	2 lb/100 gal water per treated acre		0	4 hrs	Various, see label	Do not apply this product through any type of irrigation system

Table 6. Approved nematicides for sweetpotato.

Product	When to apply	Application pattern	Incorporation depth	Rate
Mocap 10G	2 to 3 weeks preplant	Row, 12 to 15 inch band	4 to 8 inches with rotary hoe, tiller, etc., or by bedding over the band	30 to 40 lbs/A or 2.4 to 3.2 lbs/1000 ft of row (min. row spacing 42 ins)
Mocap 10 G	2 to 3 weeks preplant	Broadcast	4 to 8 inches deep	60 to 80 lbs/A
Mocap EC	2 to 3 weeks preplant	Broadcast	4 to 8 inches deep	1 to 1.33 gals/A
Vydate L ¹	Within 1 week before or at planting	Broadcast or in furrow. Transplant drench	4 to 8 inches deep	2 to 3 gals/A broadcast or 1 to 2 gals/A in furrow

¹ Vydate L has registration for nematode control on potatoes only as a broadcast or in-furrow treatment. Foliar applications are registered for insect control only. For broadcast or in-furrow treatments, Vydate L should be applied in a minimum of 20 gallons of water. As a broadcast treatment thoroughly incorporate to a soil depth of 4 to 6 inches.

Table 7. Selected insecticides approved for use on insects attacking sweet potatoes.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
Actara (thiamethoxam)	1.5-3.0 oz	12	14	aphids, flea beetles, potato leaf-hopper	4A	Toxic to bees. Do not use after Platinum.
Admire Pro (imidacloprid)	4.4-10.5 fl oz - soil 1.2 fl oz - foliar	12	125 – soil 7 - foliar	aphids, flea beetles, leafhoppers, whiteflies	4A	One application to soil per season. If using as a foliar spray, no more than 3.7 fl oz per acre per season.
Agree WG (<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>)	0.5-2.0	4	0	armyworms, hornworms, loopers	11	Treat when larvae are small.
* Agri-Mek SC (abamectin)	1.75-3.5 fl oz	12	14	<i>Liriomyza</i> leafminers, spider mites	6	Must be used with a non-ionic activator type wetting, spreading and/or penetrating adjuvant., not a binder sticker type adjuvant.
Assail 30SG (acetamiprid)	1.5-4.0 oz	12	7	aphids, cucumber beetles, flea beetles, leafhoppers, whiteflies	4A	Whiteflies not on label for sweet potatoes but are for other crops on label. No more than 4 applications per season.
Avaunt (indoxacarb)	2.5-6.0 oz	12	7	cabbage looper	22	Do not apply more than 24 oz/acre per crop.
Aza-Direct (azadirachtin)	1-2 pts, up to 3.5 pts, if needed	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Azatin XL (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator.
* Baythroid XL (beta-cyfluthrin)	0.8-2.8 fl oz	12	0	cutworms, cabbage looper, flea beetles, potato leafhopper, sweet-potato weevil adults	3	No more than 16.8 oz/acre per season.
Belay (clothianidin)	9-12 fl oz	12	See note	Aphids, corn wireworm, flea beetles, leafhoppers, southern potato wireworm, sweetpotato weevil, tobacco wireworm, white grubs		In-furrow or side-dress application, including chemigation up to 50% ground cover. Supplemental label expires on Oct. 2, 2012.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	7	aphids, plant bugs	9C	Do not apply more than 8.4 oz per acre per season.
Biobit HP (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. OMRI-listed ² .
BotaniGard 22 WP, ES (<i>Beauveria bassiana</i>)	WP: 0.5-2 lb/100 gal ES: 0.5-2 qt/100/gal	4	0	aphids, thrips, whiteflies	--	May be used in greenhouses. Contact dealer for recommendations if an adjuvant must be used. Not compatible in tank mix with fungicides.
* Brigade 2 EC (bifenthrin)	9.6-19.2 oz at-plant (soil); 3.2-9.6 oz at lay-by (soil); 2.1-6.4 oz (foliar)	12	21	cucumber beetles, flea beetles, sweetpotato weevil adults (foliar), whitefringed beetle adults, white grub adults, white grubs (lay-by), wireworm adults, wireworms (at-plant and lay-by)	3	No more than 2 foliar applications, at least 21 days apart. Do not apply more than 0.5 lb active ingredient per acre per season, including soil applications.
* Capture LFR	See label for rates for LFR.					
Coragen (rynaxypyr)	3.5-5.0 fl oz	4	14	beet armyworm	28	Foliar only. No more than 4 applications per crop. Do not make more than 2 successive applications in a 30-day period. Do not apply more than 15.4 fl oz per acre per crop.

Table 7. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
Crymax WDG <i>(Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Use high rate for armyworms. Treat when larvae are young.
Deliver <i>(Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.25-1.5 lb	4	0	caterpillars	11	Use higher rates for armyworms. OMRI-listed ² .
Dialect V; Dialect Multipurpose Insecticide II (dia- tomaceous earth + pyrethrins + piperonyl butoxide)	1-6 lb	12	0	aphids, armyworms, cabbage looper	3, --	Dialect V is OMRI-listed ² (no piperonyl butoxide)
DiPel DF <i>(Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Good coverage is essential.
Entrust (spinosad)	1-3 oz	4	7	armyworms, leafminers, <i>Liriomyza</i> , loopers, thrips	5	Do not make applications less than 7 days apart or apply more than 4 times per crop. Do not apply more than 6.5 oz/acre per crop.
Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	fire ants	7D	Do not exceed a total of 0.109 lb pyriproxyfen per acre (all formula- tions, i.e., Knack IGR). Ant Bait contains 0.5% ai, or 0.10 lb at 2-lb rate.
Extinguish ((S)-methoprene)	1.0-1.5 lb	4	0	fire ants	7A	Slow-acting IGR (insect growth regulator). Best applied early spring and fall where crop will be grown. Colonies will be reduced after three weeks and eliminated after 8 to 10 weeks.
Fulfill (pymetrozine)	2.75-5.5 oz	12	14	buckthorn aphid, green peach aphid, melon aphid, potato aphid	9B	Allow a minimum of 7 days between applications. Do not exceed 11 oz/acre/season.
Imidan 70 W (phosmet)	1.3 lb	4 days for seed- bed treat- ment, 5 days for foliar	7	banded cucumber beetle, sweet- potato weevil, whitefringed beetle, suppression of white grub and wireworm	1B	No more than 5 applications per season. Do not apply through irrigation system. Crop must be mechanically harvested.
Javelin WG <i>(Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.12-1.5 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (army- worms)	11	Treat when larvae are young. Thorough coverage is essential. OMRI-listed ² .
Knack IGR (pyriproxyfen)	8 fl oz	12	3	Whiteflies	7D	Limited to two applications at least 14 days apart.
Lorsban 15G, 75WG, *Advanced (chlorpyrifos)	See labels for rates	24	preplant broad- cast treat- ment, 125 days before harvest	flea beetles, sweet potato flea beetle, wireworms (<i>Conoderus</i>)	1B	See label. Must be incorporated into soil.

Table 7. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
Malathion 8 F (malathion)	1-1.75 pt	12	3	leafhoppers, morning glory leafminer	1B	
*Mocap 15 G, *EC (ethoprop)	See labels	48	preplant see label	cucumber beetles, flea beetles, white grubs, wireworms	1B	Two to three weeks before planting.
Movento (spirotetramat)	4.0-5.0 fl oz	24	7	aphids, psyllids, whiteflies	23	Maximum of 10 fl oz/acre per season.
M-Pede 49% EC Soap, insecticidal	1-2 % V/V	12	0	aphids	--	OMRI-listed ² .
*Mustang (zeta-cypermethrin)	1.4-4.3 oz	12	1	cabbage looper, cucumber beetles, cutworms, flea beetles, grasshoppers, leafhoppers, tarnished plant bug, vegetable weevil, whitefringed beetle (adult), yellowstriped armyworm; aids in control of aphids and beet armyworm	3	A maximum of 0.3 lb ai/acre per season may be applied. Leaves cannot be used for food or feed.
Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	aphids, beetles, caterpillars, grasshoppers, leafhoppers, leafminers, thrips, weevils, whiteflies	un	Does not kill adult insects. IGR and feeding repellent. OMRI-listed ² .
Oberon 2SC (spiromesifen)	8-16 fl oz	12	7	twospotted spider mite, whiteflies	23	Maximum amount per crop: 32 oz/acre. No more than 2 applications.
Oil, insecticidal	1-2 gal/100 gal	12	Up to day of harvest	leafminers, mites, whiteflies	--	
Platinum	5-8 fl oz	12	Applied at planting	aphids, Colorado potato beetles, flea beetles, potato leafhoppers	4A	For most crops that are not on the label, a 120-day plant-back interval must be observed. To manage resistance, avoid using Actara or Provado in conjunction with Platinum.
Platinum 75SG (thiamethoxam)	1.66-2.67 oz					
Provado 1.6F (imidacloprid)	3.5 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	Limited to 3 applications.
Radiant SC (spinetoram)	6-8 fl oz	4	7	armyworm, Colorado potato beetle, dipterous leafminer, loopers, thrips	5	Do not make more than 4 applications per year.
Rimon 0.83 EC (novaluron)	6-12 fl oz	12	14	armyworms, loopers, other foliage feeding caterpillars, sweet potato leafminer, whiteflies	15	Do not apply more than 24 oz per acre per season. Limited to two applications for whiteflies (12-oz rate).
Sevin 80S; XLR; 4F (carbaryl)	80S: 1.25-2.5 lb XLR, 4F: 1-2 qt	12	7	corn earworm, cucumber beetles, flea beetles, sweetpotato hornworm, sweetpotato weevil (preplant dip), tortoise beetle, whitefringed beetle, yellowstriped armyworm	1A	Do not apply more than 10 lb (80S) per acre per crop or 8 qt (4F, XLR). See label for preplant dip treatment.
*Telone C-35 (dichloropropene + chloropicrin)	See label	5 days - See label	preplant	symphylans, wireworms	--	See supplemental label for use restrictions in south and central Florida.
*Telone II (dichloropropene)						

Table 7. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
Trilogy (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	un	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Voliam Flexi (thiamethoxam and chlorantraniliprole)	4 oz	12	14	aphids, beet armyworm, cabbage looper, flea beetles, potato leafhopper	4A, 28	Do not exceed a total of 8 oz of product per acre per season.
Voliam Xpress* (lambda-cyhalothrin and chlorantraniliprole)	5-9 oz	24	14	aphids, armyworms, crickets, cutworms, flea beetle adults, grasshoppers, leafhoppers, loopers, saltmarsh caterpillar, stink bugs, sweet potato vine borer, webworms, others	3, 28	Do not apply more than 27.0 fl. oz of product per acre per season.
Xentari DF (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	caterpillars	11	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

The pesticide information presented in this table was current with federal and state regulations at the time of revision. The user is responsible for determining the intended use is consistent with the label of the product being used. Use pesticides safely. Read and follow label instructions.

¹Mode of Action codes for vegetable pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 6.1 August 2008.

- 1A. Acetyl cholinesterase inhibitors, Carbamates (nerve action)
- 1B. Acetyl cholinesterase inhibitors, Organophosphates (nerve action)
- 2A. GABA-gated chloride channel antagonists (nerve action)
3. Sodium channel modulators (nerve action)
- 4A. Nicotinic acetylcholine receptor agonists (nerve action)
5. Nicotinic acetylcholine receptor allosteric activators (nerve action)
6. Chloride channel activators (nerve and muscle action)
- 7A. Juvenile hormone mimics (growth regulation)
- 7C. Juvenile hormone mimics (growth regulation)
- 9B and 9C. Selective homopteran feeding blockers
10. Mite growth inhibitors (growth regulation)
11. Microbial disruptors of insect midgut membranes
- 12B. Inhibitors of mitochondrial ATP synthase (energy metabolism)
15. Inhibitors of chitin biosynthesis, type 0, lepidopteran (growth regulation)
16. Inhibitors of chitin biosynthesis, type 1, homopteran (growth regulation)
17. Molting disruptor, dipteran (growth regulation)
18. Ecdysone receptor agonists (growth regulation)
22. Voltage-dependent sodium channel blockers (nerve action)
23. Inhibitors of acetyl Co-A carboxylase (lipid synthesis, growth regulation)
28. Ryanodine receptor modulators (nerve and muscle action)
- un. Compounds of unknown or uncertain mode of action

² OMRI-listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted Use Only.