

## Chapter 18. Radish Production in Florida

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### BOTANY

#### Nomenclature

**Family** - Brassicaceae (Cruciferae)

**Radish** - *Raphanus sativus*

#### Origin

Radish is believed to be native to China.

#### Related Species

Virtually every plant part is consumed across the various vegetables in the Brassicaceae family. Other root crops are horseradish, turnip, and rutabaga. The stem is utilized from kohlrabi. Leaves of mustard, kale, collards, and watercress are food sources. Cabbage and Brussels sprouts vegetative buds are consumed, while the reproductive buds of broccoli and cauliflower are the plant parts used.

### VARIETIES

**Escala F1:** Round bulbs with fine and strong foliage in difficult climates, red, very uniform in shape and size, medium top size.

**Fuego:** Oval-round, deep scarlet red roots, tops medium-short. R to For, T to Ar and Rs.

**Red castle:** Globe, deep red, medium top size, matures in 25-28 days, very uniform root size and shape, medium upright tops, use for bunching, cello, slicing, excellent flesh quality with white interior, field tolerance to pithing.

**Red Satin F1:** Globe, glossy red, medium top size, matures in 26-30 days, very uniform root size and shape, crisp flesh, excellent field holding ability with thick cuticle, medium tops, and field tolerance to pithing.

**Red Silk:** open pollinated, globe, red, medium top size, silky smooth shoulders, matures in 26-30 days, use for bunching, and excellent flesh quality with white interior, highly adaptable to Florida muck and similar growing conditions, low pH soils. R to pithing, IR to Ar, For, Pb, and Rs.

**Rudi:** round bulbs with fine roots, red, sturdy dark green foliage, slow to turn 'pithy', adapts to difficult weather or climates very well.

#### Disease Key

**Black root** (Ar = *Aphanomyces raphani*)

**Yellows** (For = *Fusarium ocysporum f.sp. raphani*)

**Clubroots** (Pb = *Plasmodiophora brassica*)

**Rhizoctonia scurf** (Rs = *Rhizoctonia solani*)

**R** – Resistant

**IR** – Intermediate Resistance

**T** - Tolerant

### SEEDING AND PLANTING

Planting dates and seeding information are given in Table 1.

### FERTILIZER AND LIME

For mineral soils, broadcast all P<sub>2</sub>O<sub>5</sub>, micronutrients, and 25 to 50% of N and K<sub>2</sub>O. Topdress remaining N and K<sub>2</sub>O 10 to 15 days after seeding. Amount of P fertilizer should be satisfactory for up to three crops. K amount is for each crop.

**Table 1.** Seeding and planting information for radish.

Planting dates	
North Florida	Sept - Mar
Central Florida	Sept - Mar
South Florida	Oct - Mar
Seeding information	
Distance between rows (in)	6
Distance between plants (in)	1
Seeding depth (in)	0.25
Seed per acre (lb)	10 - 20
Days to maturity from seed	20-30
Plant population <sup>1</sup> (acre)	1 million +

<sup>1</sup> Population based on closest between and within row spacing.

For Histosol soils, broadcast all fertilizers. Supplemental N at a rate of 30 lbs/A might be needed in cool winter weather or after leaching rain.

Soil test and fertilizer recommendations for mineral soils are given in Table 2. Soil test and fertilizer recommendations for Histosols are given in Table 3.

### IRRIGATION

Radish water requirements (see Chapter 3, *Principles and Practices for Irrigation Management of Vegetables*, Table 4 to 6) may be less than other root crops. Peak water use during rapid growth and development will be about 80% of ETo. Water requirements will decrease to around 75% of ETo during the latter stages of plant growth (see Chapter 3, *Principles and Practices for Irrigation Management of Vegetables*, Tables 3 to 6).

### WEED MANAGEMENT

At this time, there are no preemergent herbicides labeled for radish grown on organic soils. Several trifluralin labels are registered for use on mineral soils. Glyphosate and carfentrazone (Aim) may be used preplant in a cropping system scheme. Both clethodim (Select) and sethoxydem (Poast) are now labeled for use for the postemergence control of grasses.

Preparing a good clean seedbed is very important in radish production. In many cases, the radish may emerge, grow, and be ready for harvest before competing weeds germinate and cause a problem in growth and harvest of the crop.

Several herbicides are now being evaluated in the IR-4 system to establish tolerances for radish on muck soils as well as the Chinese radish (Daikon) on both organic and mineral soils.

### PLANT TISSUE ANALYSIS

Plant tissue analysis information for radish is given in Table 4. The analysis was done near harvest, using the most recently matured leaf.

### DISEASE MANAGEMENT

Chemicals approved for disease management in radish are shown in Table 5.

### INSECT MANAGEMENT

Table 6 outlines the insecticides approved for use on insects attacking radish.

**Table 2.** Soil test and fertilizer recommendations for mineral soils for radish.<sup>1</sup>

Target pH	N lb/A <sup>2</sup>	P <sub>2</sub> O <sub>5</sub> <sup>2</sup>					K <sub>2</sub> O				
		VL	L	M	H	VH	VL	L	M	H	VH
6.5	90	120	100	80	0	0	120	100	80	0	0

<sup>1</sup> See Chapter 2 section on supplemental fertilizer application and best management practices, pg 11.

<sup>2</sup> 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 P<sub>2</sub>O<sub>5</sub>, and applied through the plant hole or near the seeds.

**Table 3.** Soil test and fertilizer recommendations for Histosol soils for radish, with target pH = 6.5 and N rate = 0 lb/A.

P and K index and fertilizer rate <sup>1</sup>				
P index	3	6	9	12
P <sub>2</sub> O <sub>5</sub> (lb/A)	100	40	0	0
K index	50	80	110	140
K <sub>2</sub> O (lb/A)	100	40	0	0

<sup>1</sup> 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 P<sub>2</sub>O<sub>5</sub>, and applied through the plant hole or near the seeds.

**Table 4.** Plant tissue analysis near harvest for radish. Dry wt. basis.

Status	N	P	K	Ca	Mg	S	Fe	Mn	Zn	B	Cu	Mo
	Percent						Parts per million					
Deficient	<3.0	0.25	1.5	0.5	0.3	0.3	30	20	30	15	3	0.1
Adequate range	3.0-4.5	0.25-0.4	1.5-3.0	0.5-2.0	0.3-0.5	0.3-0.6	30-50	20-40	30-50	15-30	3-10	0.1 -2.0
High	>4.5	0.4	3.0	2.0	0.5	0.6	50	40	50	30	10	2.0
Toxic										>85		

**Table 5.** Radish fungicides and other disease management products.

Chemical	FRAC Group	Max Rate / Acre		Min. Days to Harvest	Pertinent Diseases	Select Remarks
		Application	Season			
Allegiance FL (metalaxyl)	4	0.75 fl oz/ 100 lb seed			Pythium seedling blight	Seed treatment only
Actinovate AG ( <i>Streptomyces lydicus</i> )	NC	12 oz	12 oz	0	Various (see label)	Apply to soil through irrigation, as a seed treatment, to foliage as a spray. See label for details.
Apron XL LS (mefenoxam)	4	0.64 fl. oz./ 100 lb seed			Pythium seedling blight	Seed treatment only
Cabrio EG (pyraclostrobin)	11	16 oz	48 oz	0	Various (see label)	Do not exceed 2 sequential and 3 total applications of Cabrio or other QoI fungicides.
Cease ( <i>Bacillus subtilis</i> strain QST 713)	NC	6 qt/100 gal		0	Black root Black crown rot	Apply to soil through irrigation, or to foliage as a spray. See label for details.
Contans WG ( <i>Coniothyrium minitans</i> strain CON/M/91-08)	NC	6 lbs			Sclerotinia diseases	Apply to soil surface and incorporate prior to, at planting, or at transplanting.
Defiant 75WP (thiram)	M3	5.3 oz/ 100 lbs of seed			Damping off	Seed treatment only.
Flint (trifloxystrobin)	11	4 oz	8 oz	7	Alternaria leafspot Septoria leafspot	Alternate every other application with a fungicide of dissimilar mode of action.
Phosphonic fungicides (See individual labels) including: Fosphite, Fungi-Phite, Rampart, Topaz (potassium phosphite) Phorcephite (potassium phosphite/potassium phosphate)	33	3 qt	18 qt		Pythium, Rhizoctonia, Fusarium	Do not exceed 6 applications per crop. Caution should be used when applying in a management program including copper fungicides. See label for foliar, and irrigation application details.
Kaligreen (potassium bicarbonate)	NC	3 lb		1	Powdery mildew	Apply in a minimum spray volume of 25 GPA.
Maxim 4FS (fludioxonil)	12	0.16 fl oz/ 100 lbs of seed			Various seedling diseases	Seed treatment only.
NutraPic (chloropicrin)	NC	500 lb			Soilborne fungi Nematodes	DANGER. Soil fumigant. Restricted use pesticide. See label for details.
Oxidate (hydrogen dioxide)	NC	1:100 dilution		0	See label	See label for details.

Table 5. Continued.

Chemical	FRAC Group	Max Rate / Acre		Min. Days to Harvest	Pertinent Diseases	Select Remarks
		Application	Season			
Presidio (fluopicolide)	43	4 fl oz	12 fl oz	7	Pythium Cavity spot	Must be tank-mixed with a fungicide of dissimilar mode of action.
Quadris (azoxystrobin)	11	15.4 fl oz or 0.8 fl oz/ 1000 ft of row	3.75 qt	0	Various (see label)	Do not exceed 1 sequential and 4 total foliar applications of Quadris or other QoI fungicides. See label for soil applications.
Reason (fenamidone)	11	8.2 fl oz	24.6 fl oz	14	Downy mildew Pythium Alternaria leafspot	Alternate with fungicides with dissimilar modes of action.
Regalia (extract of <i>Reynoutria Sachalinensis</i> )	P	0.5% v/v		7	Powdery mildew Downy mildew	Begin applications preventatively. Spray volumes should be 50-100 GPA.
Ridomil Gold EC (mefenoxam)	4	2 pts/ trtd acre			Pythium seedling diseases Downy mildew	Apply at seeding in a 7-12" band on soil over seed furrow
Ridomil Gold/Copper (mefenoxam/Copper hydroxide)	4/M1	2 lb	8 lb	7	Downy mildew	Limit of 4 applications per crop
Rhapsody ( <i>Bacillus subtilis</i> strain QST 713)	NC	6 qt		0	Various (see label)	See labels for details.
Sebring 2.65ST (metalaxyl)	4	0.75 fl oz/ 100 lb of seed			Pythium damping off	Seed treatment only.
Serenade Max ( <i>Bacillus subtilis</i> strain QST 713)	NC	3 lb		0	Various (see label)	See label for details.
Serenade Soil ( <i>Bacillus subtilis</i> strain QST 713)	NC	6 qt		0	Rhizoctonia Pythium Fusarium Verticillium Phytophthora	See label for details. Soil treatment.
Soilgard 12G ( <i>Gliocladium virens</i> strain GL-21)	NC	10 lb/acre 1.5 lb/cu ft soil mix			Damping off Root diseases	See label for details.
Sonata ( <i>Bacillus pumilis</i> strain QST 2808)	NC	4 qt		0	Powdery mildew	For suppression or use as a preventative in a program with other registered fungicides.
Sporatec (Clove, Rosemary, and Thyme Oil)	NC	1.5 qt		0	Powdery mildew	Sporatec is a concentrated oil-based product. It requires the use of an approved adjuvant to improve spreading and sticking.
Sulfur fungicides (See individual labels) including: Micro Sulf, Microthiol Disperss, Sulfur 90W, Top Cop w/ Sulfur	M2	-	-	1	Powdery mildew	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
Switch 62.5WDG (cyprodinil/fludioxonil)	9 & 12	14 oz	28 oz	7	Powdery mildew Alternaria	Make no more than 2 applications on radish. See label for details.
Trilogy (neem oil)		2 gal				Apply at a rate of 0.5% - 1.0% in 25 to 100 gallons of water per acre or at 2 pt in a minimum of 5 GPA for low volume applications.

Table 6. Insecticides approved for use on insects attacking radishes.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code <sup>1</sup>	Notes
<b>Actara</b> (thiamethoxam)	1.5-4.0 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	Do not exceed 4 oz per acre per season. Use higher rate for whiteflies.
<b>Admire Pro</b> (imidacloprid)	4.4-10.5 fl oz	12	21	aphids, flea beetles, leafhoppers, thrips (foliage feeding), whiteflies	4A	Limited to one soil application.
<b>Agree WG</b> ( <i>Bacillus thuringiensis</i> subspecies <i>aizawai</i> )	0.5-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11	Apply when larvae are small for best control. OMRI-listed <sup>2</sup> .
<b>*Asana XL (0.66 EC)</b> (esfenvalerate)	5.8-9.6 fl oz	12	7	armyworms, beetles	3	Do not apply more than 0.1 lb active ingredient per acre per season. (19.2 oz)
<b>Aza-Direct</b> (azadirachtin)	1-2 pts, up to 3.5 , if needed	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator. OMRI-listed <sup>2</sup> .
<b>Azatin XL</b> (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whiteflies	un	Antifeedant, repellent, insect growth regulator.
<b>*Baythroid XL</b> (beta-cyfluthrin)	1.6-2.8 fl oz	12	0	cutworms, flea beetles, potato leafhopper	3	Do not consume tops. Maximum amount per acre per crop = 14.0 fl oz.
<b>Beleaf 50 SG</b> (flonicamid)	2.0-2.8 oz	12	3	aphids, plant bugs	9C	Do not apply more than 3 times at high rate.
<b>Biobit HP</b> ( <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 <sup>2</sup> .
<b>BotaniGard 22 WP, ES</b> ( <i>Beauveria bassiana</i> )	<b>WP:</b> 0.5-2.0 lb/100 gal <b>ES:</b> 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.
<b>*Brigade 2EC</b> (bifenthrin)	5.12-6.4 fl oz	12	21	aphids, beet armyworm, corn earworm, cutworms fall armyworm, fire ants, flea beetles, loopers, southern armyworm, spider mites, whiteflies	3	Do not apply more than 0.5 lb ai/acre per season.
<b>Crymax WDG</b> ( <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.
<b>Deliver</b> ( <i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i> )	0.25-1.5 lb	4	0	caterpillars	11	Use higher rates for armyworms. OMRI-listed <sup>2</sup> .
<b>*Diazinon AG-500, *50 W</b> (diazinon)	<b>preplant - AG500:</b> 1-4 qt <b>50W:</b> 2-8 lb	72	preplant	cutworms, mole crickets, wireworms	1B	No more than one application per year.
<b>DiPel DF</b> ( <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. OMRI-listed <sup>2</sup> .

Table 6. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code <sup>1</sup>	Notes
<b>Entrust</b> (spinosad)	1-2 oz	4	3	armyworms, dipteran leafminers, flea beetle, loopers, thrips	5	3 applications per year. No more than 6 oz per acre per crop. OMRI- listed <sup>2</sup> .
<b>Extinguish</b> ((S)-methoprene)	1-1.5 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. May be applied by ground equipment or aerially.
<b>Intrepid 2F</b> (methoxyfenozide)	6-16 fl oz	4	14	armyworms, cabbageworm, loopers, saltmarsh caterpil- lar, webworms	18	Do not apply more than 64 fl oz per acre/season.
<b>Javelin WG</b> ( <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 <sup>2</sup> .
<b>*Lannate SP</b> (methomyl)	0.5 lb	48	3	beet armyworm	1A	SLN [24(c)] label for Florida.
<b>*LV</b>	1.5 pt					
<b>Lorsban 15G, 75WG</b> (chlorpyrifos)	<b>15G:</b> 3.3 oz per 1000 ft of row <b>75WG:</b> 0.67 oz per 1000 ft of row	24	at plant- ing	root maggot	1B	One application per season.
<b>Malathion 5 EC</b> (malathion)	1.5-2 pts	12	7	aphids, diamondback moth, flea beetles, leafhoppers	1B	
<b>M-Pede 49% EC</b> Soap, insecticidal	1-2% V/V	12	0	aphids, leafhoppers, mites, thrips, whiteflies	--	OMRI-listed <sup>2</sup> .
<b>*Mustang</b> (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 can- not be used for food or feed.
<b>Neemix 4.5</b> (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, beetles, caterpillars, leaf- hoppers, leafminers, thrips, whiteflies	un	Does not kill adult insects. IGR and feeding repellent. OMRI-listed <sup>2</sup> .
<b>Platinum 75SG</b> (thiamethoxam)	5.0-6.5 fl oz 1.7-2.17 oz	12	at plant- ing	aphids, flea beetles, leaf- hoppers, whiteflies	4A	Do not exceed 6.5 fl Platinum or 2.17 oz 75SG per acre per crop.
<b>Provado 1.6F</b> (imidacloprid)	3.5 oz	12	7	aphids, flea beetles, leaf- hoppers, whiteflies	4A	One application per season.
<b>Pyrellin EC</b> (pyrethrin + rotenone)	1-2 pt	12	12 hours	aphids, leafhoppers, leafminers, loopers, mites, plant bugs, thrips, white- flies	3, 21	
<b>Radiant</b> (spinetoram)	6-8 fl oz	4	3	armyworms, dipterous leafminers, loopers, thrips	5	Maximum of 3 applications per year.

Table 6. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code <sup>1</sup>	Notes
<b>Sevin 80S; XLR; 4F</b> (carbaryl)	<b>80S:</b> 0.63-2.5 lb <b>XLR, 4F:</b> 0.5 -2.0 qt	12	7	armyworms, aster leafhop- per, corn earworm, fall armyworm, flea beetle, leafhoppers, stink bugs, tarnished plant bug	1A	Do not apply more than a total of 7.5 lb or 6 qt per acre per crop.
<b>SpinTor 2 SC</b> (spinosad)	3-6 fl oz	4	3	armyworms, flea beetle, leafminers, loopers, thrips	5	Do not apply more than 18 oz/acre per crop. Limited to 3 applications per year.
<b>Sun Spray 98.8%, others</b> Oil, insecticidal	1-2 gal/100 gal	4	0	aphids, leafhoppers, leafminers, mites, thrips, whiteflies	--	
<b>*Telone C-35</b> (dichloro- propene + chloropicrin)	See label	5 days - See label	preplant	symphyllans, wireworms	--	See supplemental label for use restrictions in certain Florida coun- ties.
<b>*Telone II</b> (dichloropropene)						
<b>Trilogy</b> (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 <sup>2</sup> .
<b>Xentari DF</b> ( <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.**

<sup>1</sup> Mode 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

<sup>2</sup> OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

**\* Restricted Use Only.**