

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 roots 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 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 P₂O₅, micronutrients, and 25 to 50% of N and K₂O. Topdress remaining N and K₂O 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 ¹ (acre)	1 million +

¹ 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

Carfentrazone (Aim) and glyphosate (various formulations) are registered for preplant burndown. Trifluralin (various formulations) and DCPA (Dacthal) are registered for preemergence weed control in mineral soils. Clethodim (Arrow, Select, Select Max) and sethoxydim (Poast) are registered for postemergence control of perennial and annual grass weeds.

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.¹

Target pH	N lb/A ²	VL	L	M	H	VH	VL	L	M	H	VH
		P ₂ O ₅ ²					K ₂ O				
		(lb/A/crop season)									
6.5	90	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. 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 ¹				
P index	3	6	9	12
P ₂ O ₅ (lb/A)	100	40	0	0
K index	50	80	110	140
K ₂ O (lb/A)	100	40	0	0

¹ 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 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.

Fungicide Group	Chemical (active ingredient)	Maximum Rate / Acre		Minimum Days to		Pertinent Diseases or Pathogens	Remarks
		Applic.	Season	Harvest	Reentry		
M2	(sulfur) Many brands available: Micro Sulf, Microthiol Disperss, Sulfur 90W, Top Cop w/ Sulfur	-	-	1	1	Powdery mildew	Do not apply during periods of warm weather. Do not apply within 2 weeks of an oil spray.
M3	Defiant 75WP (thiram)	5.3 oz/ 100 lbs of seed			1	Damping off	Seed treatment only.
4	Allegiance FL (metalaxyl)	0.75 fl oz/ 100 lb seed			1	Pythium seedling blight	Seed treatment only
4	Apron XL LS (mefenoxam)	0.64 fl. oz./ 100 lb seed			2	Pythium seedling blight	Seed treatment only
4	Ridomil Gold EC (mefenoxam)	2 pts/ trtd acre			2	Pythium seedling diseases Downy mildew	Apply at seeding in a 7-12" band on soil over seed furrow
4/M1	Ridomil Gold/Copper (mefenoxam/Copper hydrox- ide)	2 lb	8 lb	7	2	Downy mildew	Limit of 4 applications per crop
4	Sebring 2.65ST (metalaxyl)	0.75 fl oz/ 100 lb of seed			1	Pythium damping off	Seed treatment only.
4	Ultra Flourish (mefenoxam)	4 pt		7	2	Pythium seedling diseases	See label for specifics regarding preplant incorporated applica- tions and surface applications at the time of planting.
9 & 12	Switch 62.5WDG (cyprodinil/fludioxonil)	14 oz	28 oz	7	0.5	Powdery mildew Alternaria	Make no more than 2 applica- tions on radish. See label for details.
11	Cabrio EG (pyraclostrobin)	16 oz	48 oz	0	0.5	Various (see label)	Do not exceed 2 sequential and 3 total applications of Cabrio or other QoI fungicides.
11	Flint (trifloxystrobin)	4 oz	8 oz	7	0.5	Alternaria leafspot Septoria leafspot	Alternate every other application with a fungicide of dissimilar mode of action.
11	Quadris (azoxystrobin)	15.4 fl oz or 0.8 fl oz/1000 ft of row	3.75 qt	0	4 hrs	Various (see label)	Do not exceed 1 sequential and 4 total foliar applications of Quadris or other QoI fungicides. See label for soil applications.

Table 5. Continued.

Fungicide Group	Chemical (active ingredient)	Maximum Rate / Acre		Minimum Days to		Pertinent Diseases or Pathogens	Remarks
		Applic.	Season	Harvest	Reentry		
11	Reason (fenamidone)	8.2 fl oz	24.6 fl oz	14	0.5	Downy mildew Pythium Alternaria leafspot	Alternate with fungicides with dissimilar modes of action.
12	Maxim 4FS (fludioxonil)	0.16 fl oz/ 100 lbs of seed			0.5	Various seedling diseases	Seed treatment only.
33	Phosphonic fungicides (See individual labels) including: Fosphite, Fungi-Phite, Rampart, Topaz (potassium phosphite) Phorcephite (potassium phosphite/potassium phosphate)	3 qt	18 qt		4 hrs	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.
43	Presidio (fluopicolide)	4 fl oz	12 fl oz	7	0.5	Pythium Cavity spot	Must be tank-mixed with a fungicide of dissimilar mode of action.
P	Regalia (extract of <i>Reynoutria Sachalinensis</i>)	0.5% v/v		7	4 hrs	Powdery mildew Downy mildew	Begin applications preventatively. Spray volumes should be 50-100 GPA.
NC	Actinovate AG (<i>Streptomyces lydicus</i>)	12 oz	12 oz	0	1 hr	Various (see label)	Apply to soil through irrigation, as a seed treatment, to foliage as a spray. See label for details.
NC	Cease (<i>Bacillus subtilis</i> strain QST 713)	6 qt/100 gal		0	4 hrs	Black root Black crown rot	Apply to soil through irrigation, or to foliage as a spray. See label for details.
NC	Contans WG (<i>Coniothyrium minitans</i> strain CON/M/91-08)	6 lbs			4 hrs	Sclerotinia diseases	Apply to soil surface and incorporate prior to, at planting, or at transplanting.
NC	Kaligreen (potassium bicarbonate)	3 lb		1	4 hrs	Powdery mildew	Apply in a minimum spray volume of 25 GPA.
NC	NutraPic (chloropicrin)	500 lb			5	Soilborne fungi Nematodes	DANGER. Soil fumigant. Restricted use pesticide. See label for details.
NC	Oxidate (hydrogen dioxide)	1:100 dilution		0	0	See label	See label for details.
NC	Rhapsody (<i>Bacillus subtilis</i> strain QST 713)	6 qt		0	4 hrs	Various (see label)	See labels for details.
NC	Serenade Max (<i>Bacillus subtilis</i> strain QST 713)	3 lb		0	4 hrs	Various (see label)	See label for details.
NC	Serenade Soil (<i>Bacillus subtilis</i> strain QST 713)	6 qt		0	4 hrs	Rhizoctonia Pythium Fusarium Verticillium Phytophthora	See label for details. Soil treatment.
NC	Sil-Matrix (Potassium silicate)	4 qts	10 gal	0	4 hrs	Powdery mildew	Apply at a rate of 2-4 qt/100 gal water
NC	Soilgard 12G (<i>Gliocladium virens</i> strain GL-21)	10 lb/acre 1.5 lb/cu ft soil mix			0	Damping off Root diseases	See label for details.

Table 5. Continued.

Fungicide Group	Chemical (active ingredient)	Maximum Rate / Acre		Minimum Days to		Pertinent Diseases or Pathogens	Remarks
		Applic.	Season	Harvest	Reentry		
NC	Sonata (<i>Bacillus pumilis</i> strain QST 2808)	4 qt		0	4 hrs	Powdery mildew	For suppression or use as a preventative in a program with other registered fungicides.
NC	Sporatec (Clove, Rosemary, and Thyme Oil)	1.5 qt		0	0	Powdery mildew	Sporatec is a concentrated oil-based product. It requires the use of an approved adjuvant to improve spreading and sticking.
NC	Tenet WP (<i>Trichoderma asperellum</i> and <i>T. gamsii</i>)	3 oz/ 1000 ft of row			1 hr	Various soil-borne diseases	Apply up to 7 days before planting. For organic production.
NC	TerraClean (Hydrogen dioxide)	1 gal/ 1000 gal of water			0	Various soil-borne diseases	Apply as a soil treatment prior to or after planting
NC	Trilogy (neem oil)	2 gal			4 hrs		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 ¹	Notes
Actara (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.
Admire Pro (imidacloprid)	4.4-10.5 fl oz	12	21	aphids, flea beetles, leafhoppers, thrips (foliage feeding), whiteflies	4A	Limited to one soil application.
Agree WG (<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 ² .
*Asana XL (0.66 EC) (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)
Aza-Direct (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 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)	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.
Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	3	aphids, plant bugs	9C	Do not apply more than 3 times at high rate.
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: 0.5-2.0 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 2EC (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.
Coragen (chlorantraniliprole)	3.5-5.0 fl oz	4	1	beet armyworm	28	Do not make more than 4 applications per acre per crop or a maximum of 15.4 fl oz per acre per year.
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 .
*Diazinon AG-500, 50 W (diazinon)	preplant - AG500: 1-4 qt 50W: 2-8 lb	72	preplant	cutworms, mole crickets, wireworms	1B	No more than one application per year.
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. OMRI-listed ² .

Table 6. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code ¹	Notes
Entrust (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 ² .
Extinguish ((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 elimi- nated after 8 to 10 weeks. May be applied by ground equipment or aerially.
Intrepid 2F (methoxyfenozide)	6-16 fl oz	4	14	armyworms, cabbageworm, loopers, saltmarsh caterpillar, webworms	18	Do not apply more than 64 fl oz per acre/season.
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	Do not apply more than twice per growing season.
*Lannate SP (methomyl)	0.5 lb	48	3	beet armyworm	1A	SLN [24(c)] label for Florida.
*LV	1.5 pt					
Lorsban 15G, 75WG, Advanced (chlorpyrifos)	15G: 3.3 oz per 1000 ft of row 75WG: 0.67 oz per 1000 ft of row Advanced: 5.5 pints	24	at plant- ing	At planting: root maggot preplant application of Lorsban Advanced: billbugs, cutworms, grubs, symphylans, wireworms	1B	One application per season.
			preplant			
Malathion 5 EC (malathion)	1.5-2 pts	12	7	aphids, diamondback moth, flea beetles, leafhoppers	1B	
M-Pede 49% EC Soap, insecticidal	1-2% V/V	12	0	aphids, leafhoppers, mites, thrips, whiteflies	--	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, armyworms, beetles, cat- erpillars, leafhoppers, leafminers, thrips, whiteflies	un	Does not kill adult insects. IGR and feeding repellent. OMRI-listed ² .
Platinum 75SG (thiamethoxam)	5.0-6.5 fl oz 1.7-2.17 oz	12	at plant- ing	aphids, flea beetles, leafhoppers, whiteflies	4A	Do not exceed 6.5 fl Platinum or 2.17 oz 75SG per acre per crop.
Provado 1.6F (imidacloprid)	3.5 oz	12	7	aphids, flea beetles, leafhoppers, whiteflies	4A	One application per season.
Radiant (spinetoram)	6-8 fl oz	4	3	armyworms, dipterous leafmin- ers, 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 ¹	Notes
Sevin 80S; XLR; 4F (carbaryl)	80S: 0.63-2.5 lb XLR, 4F: 0.5 -2.0 qt	12	7	armyworms, aster leafhopper, 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.
Sun Spray 98.8%, others Oil, insecticidal	1-2 gal/100 gal	4	0	aphids, leafhoppers, leafminers, mites, thrips, whiteflies	--	
*Telone C-35 (dichloropropene + chloropicrin)	See label	5 days -	preplant	symphylans, wireworms	--	See supplemental label for use restrictions in certain Florida counties.
*Telone II (dichloropropene)		See label				
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 .
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.