# Crop Profile for Radish in Florida

**Prepared: April 2008**

## Production Facts

- Radish production in Florida has declined substantially from a peak of approximately 30,000 acres in the late 1980's to between 4,000 and 6,000 acres currently. Decline is largely based on reduced demand for the crop (personal communication, Dr. R. Raid, UF/IFAS).

- The majority of radish is grown on muck soil in the Everglades agricultural area. Less than 100 acres of bunch radish are produced on sandy mineral soils in the state (personal communication, Dr. R. Raid, UF/IFAS).

- Very few pest management tools are used in the crop, as it is fast growing during the cool season.

- Radish is a relatively simple crop to grow. It is planted mechanically by seed and mechanically harvested. The plants are trimmed and bagged automatically after harvest (personal communication, Dr. W. Stall, UF/FAS).

### Production Regions

Radishes are produced by three growing operations which all operate in the West Palm Beach area near Lake Okeechobee. Historic radish acreage in central Florida was purchased by the state in the mid 1990s.

### Production Practices

Radish is a cool season crop with a short growth period. Some of the varieties that are grown include ‘Fireball’, ‘Fuego’, and ‘Red Silk’. Primary planting dates for radish in Florida range from October to March (Stall et al., 2007).

Seeds are planted at a distance of 6 inches between rows and 1 inch between plants, giving a plant population of over one million plants per acre. Seeds are planted at a depth of 0.25 inch. Between 20 and 30 days are required from seed to maturity, depending on the variety (Stall et al., 2007).

The radish crop requires less water than other root crops. Peak water use during rapid growth and development will be about 80 percent of the rate of daily pan evaporation,



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and decreases slightly during the later stages of plant development. Seepage-type irrigation is the most commonly used irrigation for Florida radish (Stall et al., 2007).

### Worker Activities

There are no worker activities associated with bulb radish production on muck soils. Hand-pulling is required for the small amount of acreage devoted to bunch radish production. A worker can harvest approximately two acres a day and generally work bare handed.

## Insect Management

***Insect Pests***

The greatest insect problem for growers in the state is the diamondback moth (*Plutella xylostella*) and aphids. Insect pests that have been considered major in the past and are only occasionally a problem now include cutworms and wireworms (Webb, 2007).

**DIAMONDBACK MOTH** (*Plutella xylostella)*. Plants at all stages of growth may be attacked. The moth lays its eggs on the lower surface of leaves in groups of two to three. In approximately one day the eggs hatch, and the larvae begin to feed on the leaves. Feeding results in many small holes that grow larger as the larvae increase in size. Often, feeding does not go through the entire leaf, leaving a thin layer of the leaf epidermis. The larval stage can range from ten days to a month, depending on temperature. Diamondback moth larvae slow their feeding at temperatures below 50°F, and population growth is most rapid at temperatures greater than 80°F. The pupal stage is passed within a transparent, loose cocoon, which is usually attached to the underside of leaves. Within about one to two weeks of entering the pupal stage, the moths emerge (Hayslip et al. 1953; Webb, 2007).

**APHIDS** [turnip aphid (*Hyadaphis erysimi*), green peach aphid (*Myzus persicae*), cabbage aphid (*Brevicoryne brassicae*)]. Aphids suck plant juices with their piercing-sucking mouthparts, resulting in yellowing and curling of the leaves. The plant, particularly when attacked as a seedling, may be stunted or die as a result of aphid feeding. Aphids can be protected from insecticide sprays within the curled leaves (Hayslip et al., 1953; Webb, 2007).

**CUTWORMS** black cutworm (*Agrotis ipsilon*) and granulate cutworm (*Feltia subterranea*). Cutworms are stout, gray caterpillars with a greasy appearance. They are active at night, feeding on the stems and leaves. During the day, they take refuge in the soil at the base of the plants. They can also cut out large holes from leaves touching the soil surface (Hayslip et al., 1953). Several plants in a row are usually affected, and the cutworm often pulls into a protected area of the soil with the end of the leaf on which it is feeding (Workman, 1983).

The black cutworm is one of the most destructive of the cutworms and attacks a wide range of plants. Although cutworm larvae can migrate into a field from adjacent areas, most migration occurs by adults flying into the field. The moth deposits eggs in groups of one to 30 on leaves or stems near ground level. The egg stage lasts from 5 to 15 days, the larval stage lasts from three to four weeks, and the pupal stage takes 12 to 36 days. At high temperatures, when development is more rapid, the life cycle can be completed in six or seven weeks. The life cycle of the granulate cutworm is similar to that of the black cutworm (Hayslip et al., 1953).

***Chemical Control***

Historical reports of insecticide use portray a crop in which little pesticide is used. In the early 1990's nearly half the crop was sprayed with methomyl or esfenvalerate once. However, by the mid-1990's, only five to ten percent of the acreage was sprayed with either of these compounds. Other insecticides registered for use in Florida radish production include: azadirachtin, B.t., carbaryl, chlorpyrifos, cyfluthrin, deltamethrin, diazinon, esfenvalerate, imidacloprid, malathion, methomyl, methoxyfenozide, petroleum oil, pyrethrins, spinetoram, spinosad, sulfur, and thiamethoxam. Methoprene is labeled for fire ant control in radish.

***Cultural Control***

Most of the cultural control provided to the radish crop comes in the form of proper field preparation. By short-fallow and discing, soil fumigants are not required.

***Biological Control***

Diamondback moth populations in Florida have been observed to suffer a high parasitism rate by *Trichogramma* sp. and to be affected by several pathogens, including *Zoophthora* spp. (Leibee, 1996). Additional natural enemies of brassica pests reported in Florida include the parasites *Meteorus vulgaris*, a braconid wasp that has been found attacking granulate cutworm and fall armyworm in the Everglades area, the encyrtid wasp *Copidosoma truncatellum*, a parasite of the cabbage looper, the ichneumonid wasp *Horogenes insularis*, which attacks diamondback moth and cabbage looper, the braconid wasp *Diatretus rapae*, which parasitizes cabbage and turnip aphids, and the tachinid flies *Archytas piliventris* and *Eucelatoria rubentis*, which attack armyworms and cutworms. Predators of radish insects reported in Florida include the pentatomid bugs *Podisus maculiventris* and *Podisus mucronatus*, which feed on cabbage loopers and imported cabbageworms, and the reduviid bug *Zelus bilobus*, which also attacks cabbage loopers and imported cabbageworms. Other predaceous bugs include the

pentatomids *Stiretrus anchorago* and *Euthyrhynchus floridanus*, and the reduviids *Arilus cristatus* and *Sinea diadema*. In addition, ground beetles of the genus *Calosoma* have played a role in biological control of cabbage pests. The native species *C. scrutator* and *C. sayi* frequently feed on cutworms and armyworms. Finally, the ladybird beetles *Cycloneda sanguinea immaculata*, *Hippodamia convergens*, *Ceratomegilla fuscilabris floridanus*, *Scymnus collaris*, *Scymnus terminatus*, *Exochomus marginipennis*, *Psyllobora* sp., and *Coccinella novemnotata* are all aphid feeders found in Florida (Hayslip et al., 1953).

## Disease Management

***Disease Pathogens***

The most significant diseases on radish in Florida are black root (caused by *Aphanomyces raphani*), downy mildew (caused by *Peronospora parasitica*), white rust (caused by *Albugo candida*), and *Rhizoctonia* diseases such as damping off and wirestem (personal communication, Dr. R. Raid, UF/IFAS).

**BLACK ROOT** An oomycete causes infection that starts as bluish-black specks where the secondary roots exit the bulb. The organism can infect the root, making it thin and hard, or completely rot the root tissue. The disease flourishes under warm, moist conditions. If it infects at a low enough point on the radish bulb, that tissue is trimmed and the bulb is marketable (personal communication, Dr. R. Raid, UF/IFAS).

**DOWNY MILDEW**. The organism causing downy mildew of radish also attacks other crucifers, such as cabbage, cauliflower, collards, Chinese cabbage, Brussels sprouts, broccoli, kale, and kohlrabi (McRitchie, 1973). The first symptoms of downy mildew are the formation of black specks and yellow-brown spots on the upper leaf surface, accompanied by the development of a fluffy mold growth on the lower surface. Young leaves may fall off when infected, and on older leaves, the spots may coalesce, producing large, sunken, tan spots. The disease can attack plants at any growth stage (Momol et al., 2005).

Disease development can be extremely rapid, affecting an entire field within three to four days under favorable conditions (cool, moist weather). Although spore production can occur at temperatures ranging from 39 to 85°F (4 to 29°C), optimum temperatures are between 53 and 61°F (12 to 16°C). Germination and penetration of the spores is most rapid at temperatures between 42 and 61°F (6 to 16°C) and can occur at any temperature between 39 and 75°F (4 and 24°C). At temperatures around 75°F (24°C), symptoms occur within three to four days of infection. When temperatures are suitable, disease development progresses more rapidly under wetter conditions (Kucharek, 2000).

The fungus that causes downy mildew can be spread by infected transplants or windblown spores produced in the lesions on the lower leaf surface of infected plants. Another type of spore, functioning as a survival spore, is produced within infected plant tissue during crop senescence and may serve as a source of inoculum for later crops. However, the role of the survival spores in disease spread is considered minimal (Kucharek, 2000).

**WIRESTEM**. The causal fungus can attack roots, stems, and leaves. In some cases, a seedling's outer stem will shrivel, turn dark, and become tough. Under appropriate weather conditions, such seedlings can recover (Momol et al., 2005).

**WHITE RUST**. Infected plants exhibit white, blister-like pustules on the leaves, mostly on the lower surface and petioles. Pustules are about 1/8 inch in diameter and can be solitary or grouped. Leaves with numerous infections will discolor and brown (personal communication, Dr. R. Raid, UF/IFAS)

***Chemical Control***

There is occasional use of azoxystrobin to treat white rust and mefenoxam to treat downy mildew outbreaks. Other fungicidal materials registered for use in Florida radish as of 2007 were: copper hydroxide, phosphoric acid compounds, pyraclostrobin, and sulfur. Fludioxonil is available as a seed treatment.

***Cultural Control***

Most of the cultural control provided to the radish crop comes in the form of proper field preparation and seed selection. Field varieties usually have some amount of disease resistance. By short-fallow and discing, soil fumigants are not required, and proper drainage alleviates root rot and other fungal problems.

***Biological Control***

Several species of bacteria (*Bacillus subtilis*, *Bacillus pumilus*) are registered for use in radish. However, with radish being a short production cycle crop, long-term disease suppression that these products tout/offer is not realized.

## Nematode & Weed Management

With proper field preparation, fertility, and irrigation, radish plants outgrow nematodes and out-compete weeds in muck soils. Neither herbicides nor nematicides are required or used in Florida radish production (personal communication, Dr. W. Stall).

## Key Contacts

Mark Mossler is a pesticide information specialist for the Agronomy Department's Pesticide Information Office at the University of Florida's Institute of Food and Agricultural Sciences. He is responsible for providing pesticide information to the public and governmental agencies. Dr. Mossler can be reached at UF/IFAS PIO, Box 110710, Gainesville, FL 32611, (352) 392-4721, plantdoc@ufl.edu.

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