

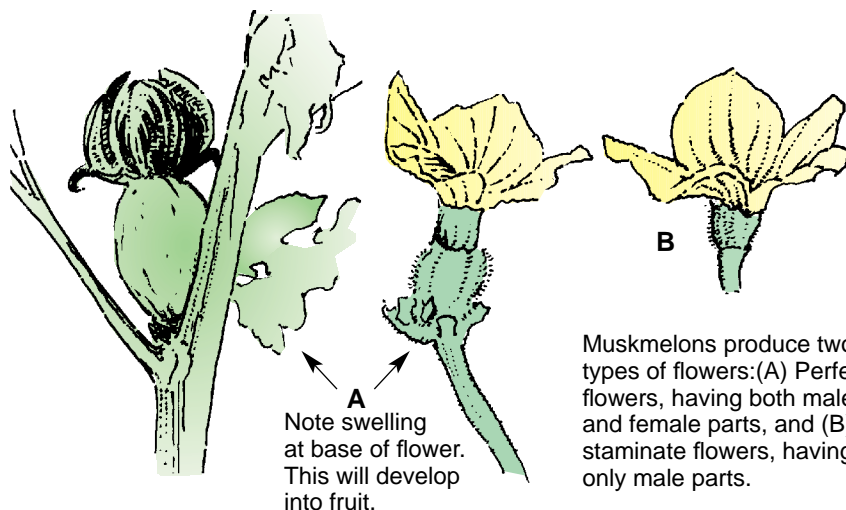
Guide to the Commercial Production of Muskmelon (Cantaloupe) and Related Melons

Historical Perspective

Muskmelons, often called cantaloupes in the United States, are not commonly grown here. True cantaloupes have deeply grooved fruit with a hard, warty, or scaly rind and orange or green flesh. Muskmelons (*Cucumis melo* L. Reticulatus Group), on the other hand, possess a fruit rind that is netted. The muskmelon is a member of the Cucurbitaceae (cucumber) family, which also includes cucumbers, watermelons, and honey dew, Persian, casaba, and crenshaw melons.

Evidence suggests that muskmelons were cultivated in Egypt as early as 2400 B.C. Little information exists, however, describing how the plant was used in ancient times. A native of Middle Eastern countries, muskmelons spread slowly to Europe. In the fifteenth century, muskmelons became popular in Spain and were soon introduced to the New World. By the mid-1600s, muskmelons were grown from Florida to New England. The modern muskmelon is derived from the 'Netted Gem,' a highly netted cultivar introduced by the W. Altee Burpee Company in 1881.

In the United States, muskmelon production is concentrated in arid and semi-arid regions, but they are grown in many states for local and interstate sales. California accounts for 70 percent of total U.S. production, followed by Texas and Arizona. Nutritionally, the muskmelon is much higher in vitamins A and C than the white-fleshed honey dew or winter melons (casaba or crenshaw).



Flowers And Pollination

Muskmelons produce two types of flowers—perfect flowers, having both male and female parts, and staminate flowers, having only male parts. Perfect flowers upon pollination and fertilization will develop into the familiar fruits. Muskmelons set fruit in cycles where several fruit are set per plant in each cycle. Fruit harvested from the first cycle of fruit set have the highest quality.

Muskmelons require bees for pollination. For greater yields and larger melons, place one or two strong hives of honeybees per acre adjacent to fields of muskmelons. Hives can be removed after fruits are set. Application of pesticides should be delayed until evening when bee activity is low, as many pesticides are toxic to honeybees.

Planting Recommendations

Soil and fertility

Muskmelons grow best on well-drained, upland, silty, or (preferably) sandy loam soils with a pH level between 6.0 and 6.5. Melons planted into acidic soils (pH less than 6.0) will have yellowed foliage and produce fewer perfect flowers. Beds should be 6 to 8 inches high to facilitate drainage. If you use a cover crop, be sure to plow it under at least 1 month prior to planting.

Timely and appropriate applications of fertilizer can make a significant difference in the quality and quantity of fruit and may promote earlier harvests. Collect soil samples from each area you intend to crop and have a soil analysis performed on each sample. Soil testing eliminates much of the guesswork involved in a fertilizer program. Be sure to apply lime several months prior to planting. Contact your county Extension agent for information on how to collect a soil sample and for boxes used to submit samples.

If a soil test is not performed, apply 40 to 50 pounds of nitrogen and phosphorus (P_2O_5), and 100 to 120 pounds of potassium (K_2O) per acre at planting. At layby, sidedress with an additional 40 to 50 pounds of nitrogen per acre.

Seeding

Muskmelons may be planted by direct seeding or by transplants after all danger of frost has passed. Direct-seeded melons should be sown when the soil temperature is above 65°F, but the optimum temperature range for germination is between 70° and 95°F. Use fungicide-treated seed, as muskmelons are sensitive to damping off, especially under cool, wet, soil conditions. Sow seed at a depth of ½ to 1 inch. Seeding will require 2 to 4 pounds of seed per acre (16,000 to 20,000 seeds per pound), unless a precision-type seeder is being used.

Transplanting

The use of transplants can reduce seed cost compared to direct-seeding and result in earlier production, especially when used with polyethylene mulch. Seeding for transplant production should be done 2 to 4 weeks prior to date of transplanting.

Spacing and planting dates

Whether direct-seeding or transplanting, space rows 5 to 6 feet apart with an in-row spacing of 18 to 24 inches. This will result in stands of 3,600 to 5,500 plants per acre. Traditionally, in-row spacings up to 36 inches have been used in Alabama, but modern hybrids and open-pollinated lines perform well at closer in-row spacings, resulting in higher yields and increased uniformity. Sow or transplant 20 March to 15 April in South Alabama, 10 April to 30 April in Central Alabama, and 20 April to 15 May in North Alabama. Provide muskmelons with at least 1 inch of water per acre per week.

Varieties

Muskmelons generally are classified as *eastern-types or western shipping-types*.

- *Eastern-type characteristics:* Round to oval, usually sutured, and netted; not intended for long-distance shipping.

- *Western shipping-type characteristics:* Round to slightly oval, sutureless, very well netted, with firm flesh.

Contact your county Extension agent for the latest edition of the *Spring Vegetable Variety Trials* from the Alabama Agricultural Experiment Station, Auburn University. In the report you will find information on the performance of selected muskmelon varieties trialed in several locations throughout Alabama. As there are a large number of commercial varieties available, only those well adapted to Alabama should be grown. It is advisable to grow a small trial plot of several varieties each year to determine which are best suited to your growing conditions.

Many commercial muskmelon varieties are available with resistance to one or more diseases, notably Fusarium wilt, downy mildew, and powdery mildew. You should choose varieties that are resistant to diseases that are prevalent in your growing area. In addition, many muskmelon varieties are sensitive to air pollution (ozone, sulfur dioxide, and sulfur trioxide), as well as to applied sulfur (used for disease control). This sensitivity is cultivar dependent and may be included in descriptions of varieties found in variety trial reports.

The following list of other types of melons are considered to be *specialty* melons in the United States, but they have similar cultural requirements to muskmelons. Demand for these types of melons tends to be regional but may offer a potential for smaller growers or those who specialize in niche markets. Before considering growing any of these melons, explore the market potential of them in your region. Available commercial varieties are listed following the descriptions of the various types of melons that follow.

Honey dew

Smooth, greenish white rind, turning creamy when ripe. Light green, sweet flesh with some orange fleshed varieties available. Fruit 7 x 7½ inches, 5 to 6 pounds. Varieties: 'Earlidew,' 'Honey Dew Green Flesh,' 'Tam Dew,' 'Honey Dew Orange' (orange flesh).

Casaba

A non-slip (see Harvesting section), late maturing, corrugated yellow, sometimes greenish yellow rind, not netted or ribbed, with white, spicy, sweet, and tender flesh. Fruit acorn-shaped, 8 x 7 inches, 7 to 8 pounds. Varieties: 'Casaba Golden Beauty,' 'Casaba Sungold' (earliest of the casaba types), 'Marygold.'

Crenshaw

Large, late maturing, yellow and green corrugated, rough rind without netting. Pinkish orange, sweet, tender flesh with distinctive flavor. Fruit is elongated with a flattened stem end (elongated acorn-shape), 9 x 7 inches, 7 to 10 pounds. Varieties: 'Crenshaw,' 'Honeyshaw' (early), 'Early Hybrid Crenshaw,' 'Crenshaw Blanco,' 'Golden Crenshaw.'

Canary

Late maturing, bright yellow corrugated rind. Flesh is pale green to white with a pale orange seed cavity; it has a sweet and distinctive flavor. Fruit is oval, similar to crenshaw, 8 x 6 inches, 6 to 7 pounds. Varieties: 'Sweet Yellow Canary,' 'Tenerife.'

Santa Claus

Very similar to Canary type except rind is mottled green and yellow. The name is derived from the long keeping qualities of this melon. 'Santa Claus' is also the variety name.

Charentais

A popular European melon, also called 'Chaca,' 'French,' or 'Italian melon.' Smooth or slightly netted, gray-green rind with dark green, slightly furrowed sutures. Deep orange, firm, sweet flesh. Fruit is slightly elongated but mostly globe shaped 3½ to 4 inches and 1½ to 2 pounds. Varieties: 'Acor F₁' and 'Alienor F₁' (both monoecious and resistant to Fusarium races 0, 1, and 2), 'Charentais Improved,' 'Ido,' 'Oval Chaca,' 'Red Queen,' 'Panchito' (netted rind).

Mediterranean

Fruits have a green rind with slight netting with no sutures, ripening to yellow gold with some green splotches. Flesh is soft and white with a touch of pink around the seed cavity when ripe. Fruit oval 6½ x 7½ inches, 5 to 5½ pounds. Variety: 'Casablanca.'

Persian

Very late maturity, green rind with slight tan cracks or sparse netting. Orange-pink, sweet, firm flesh. Fruit is round 7½ x 8 inches, 5 to 6 pounds. Varieties: 'Persian Medium,' 'Crete' (crisp flesh, excellent for frozen melon balls).

Ogen

Melons are netted with no suture, green, sweet, and have highly aromatic flesh; the rind turns golden yellow as the melon matures. This melon will slip like muskmelon and resists splitting during periods of rainy weather. Fruit is round, 3 to 5 pounds. Varieties: 'Galia,' 'Gallicum,' 'Haogen.'

Rochet

Green rind melons are slightly netted and have greenish white, sweet, and aromatic flesh. Oval. Varieties: 'Solo' (4 to 5 pounds); 'Toledo' (also called frog skin type because of the greenish yellow rind with dark green blotches); 'Verdol F₁' (dark green skin slightly netted and crisp, white, sweet flesh (resistant to Fusarium races 0, 1, and 2; also referred to as Spanish type).

Chinese 'Hami' melon

Hami is the generic Chinese word for a group of crisp-fleshed "winter" melons. Hami melons may have either red-pink, salmon, white, or green flesh. One group is slightly longer than a football but smaller in diameter (resembles Rochet type). These have yellow or yellow and green rind, usually slightly netted. The flesh is crisp and very sweet. These melons may be stored for several weeks to a few months with little quality loss. In China, these are even allowed to dry partially for use late into the fall and early winter (similar to Santa Claus melon). These appear to also be particularly suited for frozen melon balls.

Oval, 6 to 9 pounds. Varieties: 'New Century,' 'Red-Pink Hami,' 'Tiger-Skin Hami.' Round type Chinese Hami variety: 'Snow Charm' (better adapted to cooler areas). Fruit can reach very large size (10 to 12 pounds but more commonly 3 to 4 pounds), globe shaped, white to light yellow, smooth rind, light orange to pink flesh, crisp texture, sweet, excellent frozen.

Japanese melons

These melons are extremely well netted, with green rind; fruit is non-slipping when ripe and very sweet. Round or slightly oval, about 7 x 8 inches, 3 to 4 pounds. Varieties: 'Tokyo King' (the classic Japanese type—white fleshed); 'Emerald Jewel' (green fleshed); 'Emerald Pearl' (green crunchy sweet flesh); 'Ginryu' and 'Zuikoh' (both have sweet, green flesh, excellent frozen); 'Amur' (Persian type with light green flesh);

'True Arus' (yellowish green), aromatic flesh; 'Theresa' (juicy green flesh); 'Toho' (green flesh).

Mulching And Drip Irrigation

Polyethylene (black plastic) mulch can offer several advantages to growers. Black plastic mulch increases the soil temperature earlier in the growing season, conserves moisture, and reduces several common problems: soil compaction and crusting, ground rot of fruit, fertilizer leaching, drowning of crops, evaporation, and competition from weeds. These benefits promote increased quality and quantity of fruit yields and result in earlier yields, especially when used in combination with transplants. The use of transplants with plastic mulch generally results in harvests that begin 7 to 14 days earlier as compared to bare ground production. Although using mulch will increase production costs, those costs should be offset by increased profits from earlier and larger yields. Drip irrigation systems must be used with plastic mulch. Be sure to offset the drip tape 3 to 4 inches from the center of the bed, 2 to 3 inches deep.

Row Covers And Windbreaks

Spunbonded polyester and perforated polyethylene row covers may be used for 4 to 8 weeks immediately after transplanting to further enhance earliness. Covers should be removed when plants begin to flower to allow proper pollination. Row covers may be replaced after pollination is completed (after 3 to 5 fruits per plant have been pollinated) to further enhance earliness.

Windbreaks are recommended where wind erosion is likely. Temporary windbreaks of winter wheat or rye prevent sandblasting of young seedlings and whipping of vines as plants begin to run. As with row covers, windbreaks also provide additional heat accumulation in the spring.

Weed Control

A weed control program for any crop begins before planting, but this is especially true for muskmelons because only a handful of herbicides are registered for use on this crop. If possible, select an area for planting where weed populations are low and there are no perennial weeds such as nutsedge, bermudagrass, or vines. Perennial weeds generally require powerful herbicides or fumigation to control. Primary tillage including moldboard plowing, disking, and bedding are considered weed control methods, since these operations generally kill most emerged weeds. It is critical to start with a clean field before planting the crop, because any emerged weed will have a significant advantage over the young muskmelon seedlings in competing for water, fertilizer, and sunlight.

Cultivation can provide effective weed control between rows as long as the cultivator can be used without damaging the crop. If plastic mulch is used, between-row cultivation may not be practical or may be limited because of potential damage to the plastic. Soil-active herbicides can be applied before mulching, but the effectiveness of post-emergence treatments may be limited because of plastic mulch. Hand weeding between rows may be a viable option in small acreage situations. Contact your county Extension agent for recommended herbicides registered for use on muskmelons.

Insect Control

Several insect pests attack muskmelon, and growers should be prepared to make management decisions regarding their control. Some of these pests may cause problems every year, and others may only be occasional pests. Contact your county Extension agent for recommended insecticides registered for use on muskmelons. Use insecticides only when necessary to conserve bee pollinators and the parasites and predators of insect pests that may normally inhabit melon fields or adjacent areas. If an insecticide application is needed, apply late in the day when bees and natural enemies are least active.

Wireworms

Wireworms are the soil-inhabiting larvae of click beetles. They have a cylindrical, hard-bodied, wire-like appearance. They are shiny, brownish yellow, and 1/2 to 1 1/2 inches long. Wireworm damage usually occurs just after transplanting or seed emergence. Larvae feed on the roots and stems of young plants, causing plants to become stunted and to wilt. Stems may have shallow, oval feeding scars or deep, circular holes where wireworms have entered. Wireworms are most likely to be a problem when melons are planted into "new" land (for example, pasture that contained grasses) or following plantings of sod or small grains. Damage is most often observed under cool, moist soil conditions and in heavier soils. There is no "rescue treatment" for wireworm damage. If a wireworm infestation is detected or suspected, a recommended pre-plant soil insecticide treatment is warranted.

Whitefringed beetles

Whitefringed beetles are named for the white stripe on both sides of the adults. As with wireworms, the soil-inhabiting larvae cause the most serious damage by feeding on the roots of young plants. Larvae are pale white to yellow, legless grubs with a dark head capsule ranging in size from about 1/16 inch to almost 1/2 inch long. Severe whitefringed beetle infestations can result in poor plant stands because of the destruction of the root system by the larvae. As with wireworms, whitefringed beetles are most likely to be a problem when melons are planted into new land. But whitefringed beetles prefer a wide variety of broadleaf weeds (particularly legumes) over grasses. If a whitefringed beetle infestation exists, the grubs can be detected in the spring before planting by turning over the soil with a spade. If grubs are observed, a recommended pre-plant soil insecticide treatment is warranted. There is no available control post-planting for whitefringe beetle.

Cucumber beetles

Two species of cucumber beetles—striped and spotted—may infest muskmelon. Both species are about 1/5 inch long with a yellow-green background color. The striped cucumber beetle has three black stripes along the length of the body, and the spotted cucumber beetle has 12 black spots on its back. In the southern states, cucumber beetles may hibernate during cold winters, or they may remain semi-active during warmer winters. The beetles begin feeding on alternate weed hosts in the early spring and can move into spring-planted melons just after seed emergence or transplanting. Cucumber beetle larvae feed on roots and stems and may cause stunting of small plants. When populations are high, the cucumber beetle adults feed on foliage and can stunt or kill seedlings or young transplants. Beetles also feed on melon rind later in the season, causing cosmetic damage that reduces the number of marketable fruit.

Cucumber beetles also serve as vectors for the transmission of a bacterium that causes bacterial wilt, a serious disease of cucurbits. The bacterium overwinters in the digestive tract of the beetles and can be transmitted to susceptible plants the following spring when the beetles become active. Transmission to plants occurs through wounds on leaves created by feeding. Once infected, plants become wilted and die. The only way to avoid bacterial wilt is to prevent the beetles from feeding on the plant. Research at Auburn University has shown that the first few weeks after beetles colonize the young cucurbit plants is the most critical period for bacterial wilt infection. Therefore, this is the most important time to target cucumber beetle controls.

There are two options for cucumber beetle control. If the area has a history of cucumber beetle and bacterial wilt problems, growers may opt to use the systemic soil insecticide carbofuran at planting. Research in other states has shown that carbofuran may provide up to 4 weeks of beetle control. The other control option is to monitor plants regularly, particularly during the susceptible early season stage, and to apply foliar insecticides if beetles are present. Pyrethroid insecticides will give the longest residual control (about 7 days). Foliar insecticides are not usually needed after beetle populations decline and plants mature.

A new type of insecticide called *Adios* is now available for cucumber beetle control. *Adios* contains a beetle feeding stimulant along with the insecticide carbaryl. Beetles taste the feeding stimulant, feed compulsively on the insecticide, and die. *Adios* is a fairly effective alternative to standard pyrethroid insecticides for control of cucumber beetles. Another advantage of *Adios* over standard foliar insecticides is that *Adios* is not harmful to bees, which are important for pollination.

Pickleworm

The pickleworm is one of the most damaging insect pests of cucurbits. This pest does not overwinter north of southern Florida, but the adult moths migrate into the northern states as the growing season progresses. Pickleworm moths are small, about ½ inch long, and easily recognizable by the wide, yellowish brown band on the outer wing margins. The body is also yellow-brown, with a purplish tinge. The tip of the abdomen has a prominent rounded brush of long hair-like scales. The closely related melonworm moth (not a serious pest) is similar in appearance, but the body behind the wings is silvery white rather than yellow-brown, and the band around the wing margins is narrower than that of the pickleworm.

Pickleworm moths are night flyers, rarely seen during the day. Females lay egg clusters on tender buds and new leaves and sometimes on the fruit. After hatching, young larvae develop inside the buds, blossoms, and leaf terminals. Older larvae are capable of moving to the fruit where they enter and complete development. Damage from a single larvae boring inside a melon will make the fruit unmarketable. The small larvae are pale green with many black spots on their upper surface; older larvae are a green-copper color except for the brown head and brown area just behind the head.

Management of pickleworm with insecticides can be difficult, because the larvae are almost always in protected locations on or in the plant itself. The best management scheme is to monitor plants weekly beginning when the first developing leaf buds and terminals are formed. If present, young pickleworm larvae can be detected by pulling apart the leaf terminals or buds. Although larvae may also be found in flower buds, the

majority will be located in the developing leaf tissue. Newly hatched larvae are only about ⅛ inch long and blend in with the green plant tissue, but they can be detected with a bit of practice (a hand lens helps). Larval treatment thresholds have not been developed for pickleworm; therefore, the current recommendation is to begin a weekly spray program with a recommended insecticide if any larvae are found on the plants. Growers who are not willing to monitor plants for signs of pickleworm usually begin a preventive spray program when the flower buds first begin to form. A successful cultural management strategy for pickleworm is early planting and harvest. As pickleworms are migratory, large populations do not develop until later in the season. This is particularly the case in central and north Alabama.

Squash vine borer

This insect is usually a greater problem on squash and pumpkins than on muskmelon, but melons, particularly in the home garden, can sometimes be attacked. The adult is a "clearwing moth," and actually looks more like a wasp. The front wings are covered with metallic, shining, olive brown scales, but the hind wings are transparent. The abdomen is ringed with red, black, and copper, and the moth flies swiftly and noisily about the plants in the daytime. Eggs are laid on stems near the base of the plant. Upon hatching, the larvae bore into the stems and tunnel along, eating the inner tissue. Larvae are a whitish cream color with a brownish head.

As with pickleworm, control with insecticides is not greatly effective, because the larvae are protected inside the stems. Fortunately, this insect is not usually a serious problem in commercial melon production. Commercial growers with a history of borer problems usually watch for moth activity around the plants, then begin a weekly spray program with a recommended insecticide if moth activity is observed. A fairly effective home-garden management strategy is to check the base of the plant stems for holes or excrement, which indicates borer infestation. If infested, stems may be slit lengthwise at the point of attack and the larvae destroyed. The stems may then be covered with moist earth to encourage development of roots. To reduce injury the following year, all vines should be destroyed soon after the final harvest. The soil should be raked or disked in the fall and turned under deeply in the spring to prevent the emergence of adults from cocoons.

Aphids and mites

Aphids are small, soft-bodied insects that feed by sucking fluid from the plant. Infestations begin when winged adults fly into fields from weeds or other crops. Later, colonies of wingless aphids, which feed near the plant base or on the undersides of young leaves, are produced on the plants. This feeding results in cupping of the leaves. When plants are heavily infested, leaf distortion and stunting are common, and fruit set may be reduced. Upper leaf surfaces may be covered with "honey dew," a substance secreted by the aphids. The honey dew also causes stickiness on fruit surfaces and is associated with the growth of black, sooty mold fungus.

In addition to feeding damage, aphids can transmit plant viruses (for example, cucumber mosaic virus, watermelon mosaic virus; see section on melon diseases for more information). Control of aphids and aphid-borne viruses are difficult with insecticides. In fact, application of some insecticides like the pyrethroids destroys the aphids' natural enemies and results in increased aphid populations. Therefore, use of pyrethroids should be avoided if possible. Overfertilization with nitrogen can also increase aphid numbers. Reflective mulches can be used to delay colonization by winged aphids and subsequent transmission of viruses. Control of weeds within the field along field borders is also of value in reducing the potential for aphid infestation. Weekly application of highly refined oils (for example, stylet oil) using high spray volume and pressure has been shown to reduce aphid-transmitted virus infection by as much as 90 percent.

Mites are actually arthropods more closely related to spiders than insects. They are tiny (about $\frac{1}{50}$ inch long) and pale yellow or red in color. A hand lens is necessary to see them clearly. They are primarily found on the undersides of leaves, where they suck plant sap and, in hot, dry weather, can defoliate vines in a few

weeks. Defoliated plants yield small, poor quality fruit. Mite infestations usually occur along the edge of a field, frequently next to a gravel or dirt road or a grassy area. Dusty conditions favor mite development. As mite populations increase, infested leaves turn yellow. The undersides of affected leaves appear tan or yellow and have a crusty texture. Mites can be identified by shaking leaves onto a sheet of white paper and watching for moving specks or by observing leaves with a hand lens. As with aphids, pyrethroid and carbamate insecticides may actually increase mite populations by destroying natural enemies of mites. Because mite infestations usually begin on the field edges, these areas should be inspected regularly, particularly during periods of hot, dry weather. If a mite infestation is found, the infested border areas may be spot treated with a recommended miticide, followed by another treatment within 5 days. Continue to monitor the affected area to ensure that the mite infestation does not spread.



Figure 1. Muskmelon infected with bacterial wilt.

Control Of Diseases And Nematodes

As with any insect or weed problem, always confirm your disease diagnosis. Consult your county Extension agent for recommended fungicides registered for use on muskmelons.

Bacterial wilt

Bacterial wilt, caused by the bacterium *Erwinia tracheiphila*, is a destructive disease of plants in the cucumber family. Although bacterial wilt is most common on muskmelon and cucumber, it can also infect squash, pumpkins, and a number of wild cucurbit plants. Watermelons and most gourds are highly resistant to the disease.



Figure 2. Positive bacterial ooze test for bacterial wilt.

Bacterial wilt is characterized initially by wilting and drying of individual leaves. Within a day or two the wilting symptoms spread to leaves up and down a runner (Figure 1). The bacteria spread from infected runners to the main stem and then to other runners within the plant. Two diagnostic techniques can be used to identify bacterial wilt in the field:

1. Cut a wilted stem near the crown and squeeze sap from the cut stem, watching for a white exudate

from the vascular bundles. Then touch a clean knife blade to the cut surface and slowly withdraw the blade from the stem. Watch for a white ooze that strings out in a fine thread between the newly cut stem surface and the knife blade.

2. Take two recently cut stem sections from near the crown of a recently wilted vine. Squeeze sap from the cut stem ends then press the two ends together. Continue to squeeze, then slowly draw the two sections apart. The presence of a thin, sticky, white strand or strands between the two sections is a positive test for bacterial wilt (Figure 2).

Positive test results are easier to

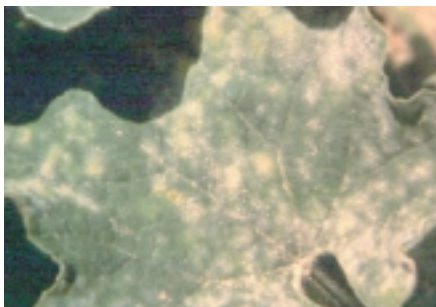


Figure 3. Powdery white appearance of powdery mildew on upper leaf surface of muskmelon.

obtain for cucumber and for some squash than for muskmelon. Because the bacteria are spread by cucumber beetles, the best and most logical control is management of the insect

vector. Consult the Insect Control section above for detailed information on control of cucumber beetles. At the first sign of disease in small plantings, wilted plants should be sprayed with a recommended insecticide and removed.

Powdery mildew

Powdery mildew, caused by the fungus *Erysiphe cichoracearum*, affects muskmelon, cucumber, pumpkin, and squash. The fungus produces a white to gray powdery growth on infected petioles, stems, and the upper surface of leaves (Figure 3). Crown leaves are usually infected first. Severely infected leaves become yellow and then turn dry, brown, and papery. Infected plants may be stunted. The loss of foliage will increase the number of sunburned fruit. Although fruit are not affected directly, severe leaf infection usually results in reduced sugar content in fruit.



Figure 4. Yellow spots of downy mildew on upper leaf surface of muskmelon.

Table 1. Recommended Control Strategies For Common Muskmelon Diseases.

	Use Resistant Varieties ^a	Follow Balanced Fertility Program ^b	Scout for Signs	Apply Recommended Fungicide ^c	Control Weeds	Allow for Good air Movement	Destroy all Crop Residue	Rotation ^d
Powdery Mildew	√	√	√	√	√	√	√	√
Downy Mildew	√	√	√	√	√	√	√	√
Anthracnose	√	√	√	√	√	√	√	√
Gummy Stem Blight		√	√	√	√	√	√	√
Alternaria Leaf Spot	√	√	√	√	√	√	√	√
Fusarium Wilt	√	√			√			√

^aAlways use certified, disease-free transplants or seed.

^bFollowing a balanced fertility program includes conducting a soil test and following its recommendations.

^cAlways be sure to get good spray coverage, especially on the lower leaf surface. Apply fungicides on a timely basis.

^dRotate with non-cucurbit crops for a minimum of 2 years; minimum of 5 years with varieties resistant to Fusarium wilt. These diseases can be carried over from year to year on cucurbit weeds or muskmelon volunteers; thus, it is important to control weeds during rotations.

The fungus can overwinter on crop debris and, more commonly, on weeds. Spores of the fungus can be blown long distances on wind currents. Infected transplants can be another source of the disease. Development of powdery mildew is favored by high temperatures (80°F) and high humidity (50 to 90 percent). Development is also favored by lush or poor plant growth (resulting from improper fertility), low light intensity, and heavy dews. When conditions are favorable, an entire field can become severely infected within a week. Powdery mildew, unlike most fungal diseases, can be a problem during periods of dry weather. See Table 1 for recommended control strategies.

Downy mildew

Downy mildew, caused by the fungus *Pseudoperonospora cubensis*, affects muskmelon and cucumber. The disease can reduce yield and fruit quality. If plants are infected early in the season, downy mildew can kill plants. The fungus causes irregularly shaped, yellowish to brown spots on the upper leaf surface (Figure 4). Spots are often angular and are restricted by the small veins of the leaf. Under moist, humid conditions, a fluffy, purplish to gray fungal growth appears on the underside of the leaf corresponding to the leaf spots above. As the spots enlarge, the leaves turn yellow and eventually die. Infected leaves that die remain erect while the edges of the leaf blade curl inward. Severe infections result in defoliation, stunting of plants, and poor fruit development. The disease usually affects older leaves first and progresses outward.

Temperatures between 60° and 70°F, heavy dews, or frequent rains favor development. The fungus can overwinter in an area or can be introduced on wind currents from considerable distances. See Table 1 for recommended control strategies.

Anthracnose

Anthracnose, caused by the fungus *Colletotrichum lagenarium*, can be a destructive disease of muskmelons during warm, wet growing seasons. The disease also attacks watermelon, cucumber, and gourds.

All aboveground plant parts are susceptible to infection, and plants can become infected at any stage in development. Older leaves first show small, water-soaked or yellowish areas that enlarge rapidly and turn tan to reddish brown (most cucurbits) or black (watermelon). Spots are often circular to angular. Later, spots may merge, blighting large sections of the leaf. These areas become dry and tear away, typically giving the foliage a ragged appearance. Often the leaves at the center of a plant are attacked first, leaving stems and runners bare. Tan to black, elongated, slightly sunken streaks (cankers) form on petioles and stems that can girdle the vine, causing death of the tissue beyond the lesion.

Fruit, if infected early, may turn black, shrivel, and die. Round, water-soaked spots, ¼ to 2½ inches in diameter, develop on the older fruit. Spots turn a dark green to brown with age and may become sunken. Under wet conditions, pinkish colored spore masses can be seen oozing out of the sunken spots.

The fungus overwinters in debris from previous host crops, in seed, or in weeds of the cucurbit family.

Warm (75°F), wet conditions (frequent rains, poor drainage) favor rapid development and spread of the disease. Anthracnose can appear anytime during the season, but most damage occurs late in the season after the fruit is set. At least three races of *Colletotrichum* have been reported. See Table 1 for recommended control strategies.

Gummy stem blight

Gummy stem blight, caused by the fungus *Mycosphaerella melonis*, is a common disease of muskmelon, watermelon, and cucumber. Symptoms first appear as grayish green, circular spots between the veins in the lobes of leaves. Spots turn a dark brown to black with age. The leaf spot stage can be confused with anthracnose; however, gummy stem lesions are darker with target-like or zonate patterns with less deterioration of the leaf tissue. Spread of the disease begins in the center of the plant and spreads outward. Lesions develop first on the vines at the nodes and elongate into water-soaked streaks that become pale brown to gray with time (Figure 5). Stem tissue often cracks and a characteristic gummy ooze exudes from the wound. Infected vines and occasionally entire plants die. The disease, unlike anthracnose, does not attack fruit.

Although the fungi that cause gummy stem blight and anthracnose are two completely different organisms, their spread and their control are very similar. Refer to the section on anthracnose for information on the environmental conditions that favor their development. See Table 1 for recommended control strategies.



Figure 5. Gummy stem blight lesion on cucurbit vine.

Alternaria Leaf Spot

Alternaria leaf spot, caused by the fungus *Alternaria cucumerina*, affects muskmelon and cucumber as well as other cucurbits. The disease causes damage by defoliating the vines and reducing fruit yield, size, and quality. Symptoms first appear on the upper leaf surface as small, circular, tan spots with white centers. Spots enlarge up to ½ inch in diameter, turn light brown, and form a slight depression. Spots on the upper leaf surface often have dark concentric rings within the lesions. Spots merge and defoliation occurs, beginning with the crown leaves.

Severe defoliation can increase the number of fruit damaged by sunburn. Symptoms on fruit appear as circular, sunken spots. Spots may be covered with a dark olive to green to black mold. Fruit turn brown and shrink, later becoming black and mummified. The rot is often associated with sunscald or over ripeness.

The fungus can overwinter in or on seed, in cucurbit weeds, and in infested plant debris. Spores of the fungus can be spread by wind and rain. The disease is favored by warm, wet (dews, rains, or overhead irrigation) conditions. Weak plants are most susceptible to the disease. See Table 1 for recommended control strategies.

Fusarium wilt

Fusarium wilt, caused by the fungus *Fusarium oxysporum* f. sp. *melonis*, only infects muskmelon, crenshaw melon, and honey dew melon. Plants infected early in their development often damp-off at the soil line. Older plants first exhibit temporary wilting during the heat of midday and generally die within a few days. Wilt symptoms develop in one or more lateral vines, starting at the tip.

When the epidermis and cortical tissue (bark) on a section of the main stem is cut back slightly above the soil line, a light brown discoloration of the vascular tissue (area just beneath the epidermis) will be evident. Brown streaks may also develop externally on the runner at the soil line and extend for some distance up the vine. Streaks are at first light brown, turning yellowish tan, then dark brown with age. This symptom is diagnostic for the disease. A white to pink fungal growth may develop on infected stems during wet weather.

The causal fungus survives from season to season in old infected vines, on seed, or in soil. The fungus can live on dead plant material or on the roots and stems of other plants such as tomatoes and several weeds. Infection occurs through the root tip, natural openings, or wounds (for example, nematode feeding sites), and eventually the fungus invades the water conducting vessels. Plugging of the vessels leads to reduced water movement followed by wilt and death. Disease incidence and severity are increased during warm, dry weather. See Table 1 for recommended control strategies.

Fusarium fruit rot

Fusarium fruit rot of muskmelon is caused by the soil-borne fungus *Fusarium roseum*. Usually ripe fruit are affected. Lesions may occur anywhere on the fruit but are frequently found at the stem end. Tan colored spots that are about 1 inch in diameter develop on fruit. Internal decay may be shallow or may extend into the seed cavity. The rotted tissue is white to rose colored, dry, and spongy. This tissue can easily be separated from the surrounding healthy tissue. A white mold develops on the surface of infected fruit during wet conditions and in storage.

This fungus is common in soil. A wound caused by insect or mechanical damage is necessary for infection. The disease is more common in thin-skinned varieties. Further infections can occur during harvesting if knives become contaminated through contact with infected plants or infested soil. Control consists of management practices that reduce fruit injury, prevent fruit contact with the soil surface, or reduce moisture on the fruit surface.

Mosaic viruses

Three viruses found commonly in muskmelons are cucumber mosaic virus (CMV), squash mosaic virus (SqMV), and watermelon mosaic virus (WMV). These viruses differ in their host range, method of transmission, and in how they overwinter. Symptoms produced by these viruses are similar, making field identification impossible. Special laboratory testing is required for positive identification.

CMV attacks more than 40 families of plants worldwide, including all vine crops. Strains of CMV differ in their host range, symptoms, and method of transmission. Cucurbits are susceptible at any stage of growth. When plants become infected in the six- to eight-leaf stage, symptoms first appear on the youngest, still expanding leaves. A mosaic pattern develops (healthy dark green leaf tissue intermingled with light green and yellow tissue (Figure 6). Leaves are often distorted, crinkled, curled, and stunted. Vines may appear bunched because of the shortening of the internodes.



Figure 6. Typical mosaic virus symptom on muskmelon leaf.

In severe cases, older leaves may die. Typical mosaic symptoms develop only on actively growing leaves. When a plant becomes infected at midseason, previous growth remains normal and produces healthy fruit. Few fruit set on plants that are infected early in the growing season. Fruit that do set, however, are often of poor quality and may be mottled green and yellow or have dark green warts.

CMV survives in almost 800 species of plants, including many weeds found in Alabama. These weeds often act as reservoir hosts allowing CMV to overwinter. The virus can be spread and transmitted by more than 60 species of aphids. Transmission is in a non-persistent manner, meaning that the aphids only need to feed on a CMV-infected plant for only a few seconds to pick up the virus.

SqMV infects most cucurbits but is rarely a problem in watermelon. On muskmelon, SqMV causes yellow spotting, a green and yellow mosaic, and green vein-banding on the leaves. A few leaves may become malformed with veins protruding beyond the leaf margin. The virus can overwinter in weeds, seed, and in cucumber beetles. Cucumber beetles are efficient vectors of SqMV, spreading the virus during feeding.

WMV affects all cucurbits and a few others including English peas and alfalfa. Symptoms vary depending on the host and plant age at the time of infection. Symptoms on most cucurbits may include stunting, leaf malformation, yellowing or light green mottling, and marginal chlorosis. Plants that are infected when they are young produce few marketable fruit. Fruit that are produced may be dwarfed, mottled, or spotted.



Figure 7. Root galls produced by root-knot nematodes.

WMV overwinters in seed or in infected weeds. In spring, the virus can be spread by many species of aphids in a non-persistent manner. Later plantings risk greater damage as disease incidence and aphid populations increase during the growing season.

Control of mosaic viruses in cucurbits begins with eradication of biennial and perennial weeds and wild reservoir hosts in and around gardens and fields. Applications of insecticides to prevent the buildup of large aphid and cucumber beetle populations, as well as other insects, will reduce virus incidence and spread. When possible, plant certified virus-free seed or transplants. Isolate later plantings far from earlier settings, especially if virus incidence was high. Removing infected plants when symptoms first appear may reduce or delay spread of the disease.

Root-knot nematodes

Root-knot nematodes, *Meloidogyne* spp., can attack cucurbits as well as more than 2,000 other species. When root-knot nematode populations are high, plants are often stunted and may wilt during dry conditions or during the hottest part of the day. Nematodes damage the root system by disrupting the flow of water and nutrients and by causing wounds that give access to diseases such as Fusarium wilt. Detecting root-knot nematodes in the field is done easily by examining roots of symptomatic plants. The nematodes cause knots or galls (Figure 7) to develop on both large and small roots; knots range in size from the head of a pin to 1 inch in diameter.

Root-knot nematodes have a wide host range that includes many cultivated crops as well as many weed species. The nematodes survive in the soil from year to year and become active as soil temperatures increase in the spring. The most effective control of root-knot nematodes is through the use of resistant varieties. Rotation with grasses and other nematode-suppressive crops (see Circular ANR-856, "Nematode Suppressive Crops") or clean fallowing during the off-season will reduce nematode populations. Soil fumigation is an effective means of reducing damaging population levels temporarily (one growing season). Soil solarization has also been shown to be effective in reducing nematode populations when environmental conditions are favorable for its use (See Circular ANR-30, "Nematode Control in the Home Garden," Circular ANR-500A, "Alabama Pest Management Handbook—Volume 1," and Circular ANR-713, "Soil Solarization for the Control of Nematodes and Soil-borne Diseases").

Harvesting

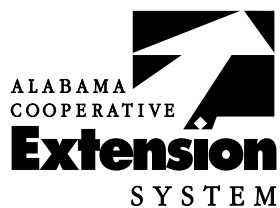
Muskmelons are harvested according to the degree of stem slip, which is when the stem begins to separate from the melon. Growers producing melons for local sale can harvest the melons at full slip (when the fruit is completely separated from the vine). At this point, the fruit has reached full maturity and peak flavor, but will soften too quickly for shipping. For shipping, it is best to harvest when the muskmelons begin to slip, usually "1/2 slip" or "3/4 slip." Fruit harvested at this stage are not as soft, but do not have as high a sugar content as those at full maturity.

Fruit are generally ready to be harvested 30 to 35 days following pollination. Frequent or daily harvests are necessary to ensure that melons are of good quality, especially if temperatures are high at time of harvest. Assuming good cultural practices, one can expect to harvest 2,000 to 5,000 melons per acre when grown on bare ground or from 6,000 to 12,000 melons when using plastic mulch.

Muskmelons need precooling soon after harvest to reduce field heat in melons. Field heat is heat accumulated by the fruit growing in a field. On days with high air temperatures, internal temperatures within the fruits will often be equal to the air temperature. If field heat is not removed, melons will degrade prematurely, resulting in poor quality melons with a greatly reduced shelf life. Precooling can be done with cold water, cold air, or ice. Hydrocooling is the most efficient method, but the choice among cooling methods depends primarily on economic factors and the type of shipping container used. Buyers generally specify packaging and shipping requirements. Room cooling and forced-air cooling are also suitable for melons, but require more time than methods above.

Room cooling is necessary after precooling in order to maintain fruit quality. Muskmelons harvested at partial slip can be held for up to 15 days at 36° to 41°F at 95 percent relative humidity. Muskmelons harvested at full slip may be held for 5 to 14 days at 32° to 36°F at 95 percent relative humidity.

The major quality factor in melons, soluble solids, is the sugar content of the fruit. A full-slip melon can have as high as 15 percent soluble solids. Melons harvested at partial slip can have soluble solids ranging from 8 to 12 percent soluble solids. Soluble solids can be measured quickly in the field with a hand-held refractometer. To maintain the sugar content as high as possible, keep the foliage healthy by controlling foliar diseases, nematodes, insect pests, and weeds. Also be sure to maintain a good fertilizer and irrigation program.



ANR-974

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