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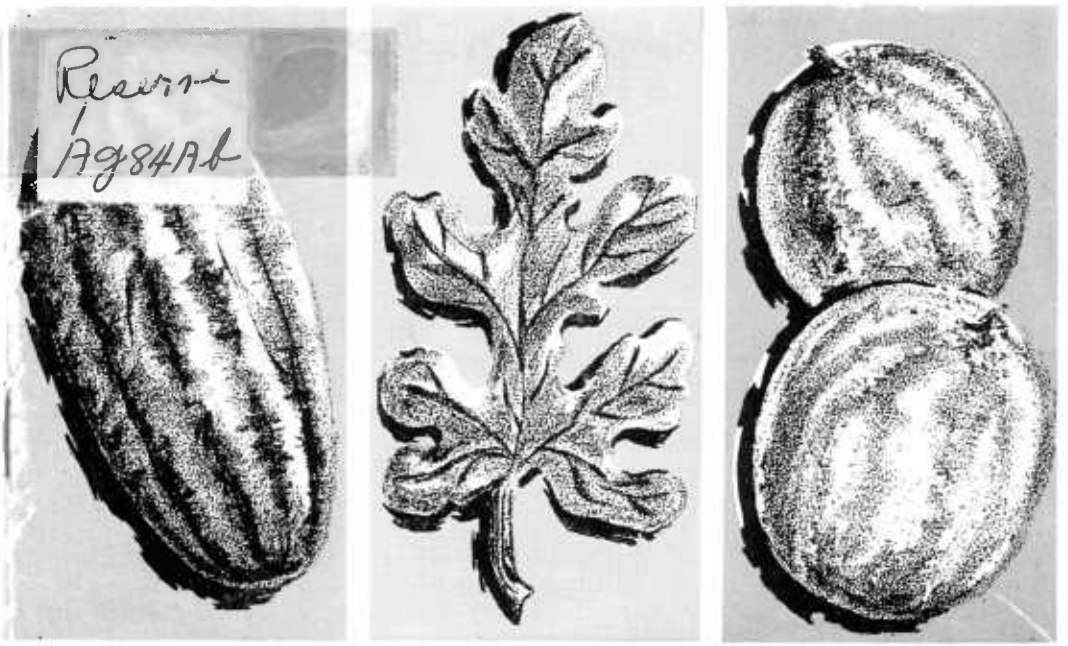

Commercial Watermelon Growing

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Contents

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COMMERCIAL WATERMELON GROWING

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The watermelon is a native of semidesert regions of tropical Africa. It is sensitive to frost and is most productive where there is a long, warm, growing season. In the 1950's, about 90 percent of the watermelon acreage of the United States was in the Southern and Southwestern States and California. Texas, Florida, Georgia, South Carolina, and Alabama produced about 70 percent of the crop, and Arkansas, Arizona, Mississippi, Oklahoma, and North Carolina were important producing States. In the Central States, Indiana and Missouri led in watermelon production.

Watermelon shipments begin in late spring from Florida and California. Shipments follow in early summer from Texas, Georgia, South Carolina, most of the other Southern States, and California. In late summer watermelons are marketed from the Central and Middle Atlantic States. The season ends about October 1.

SUITABLE SOIL TYPES

Rich sandy loam soils are the best for watermelons, but almost any well-drained, warm, and fertile soil that can be worked early in the spring is suitable. In the South, watermelons are often the first crop grown on land that has been cleared of timber. The soil of recently deforested land contains much organic matter; plants growing on it withstand dry weather better than those growing on soil that has been cropped for several years and that is low in organic matter. Newly cleared land has the advantage, also, of usually being relatively free of disease-producing organisms that may reduce the crop.

Light sandy soils are desirable for watermelons grown in regions where the growing season is short, since these soils become warm early in the spring. Watermelons are a crop that grows well on rather acid soils. An acid soil is not necessary for successful production, but lime need not be added to soils that test pH 5.0 or higher.

CROP ROTATION

From the standpoint of disease control, once in 4 years is as often as watermelons should be grown on any piece of land and once in 10 or 12 years is preferable where control of fusarium wilt and root-knot nematode is a problem.

The crops most commonly rotated with watermelons in the South are corn and cowpeas, velvetbeans, cotton, winter oats, and

[1] Died August 9, 1961.

peanuts; in the North they are corn, wheat, and clover or other pasture. A crop of velvetbeans or clover turned under during the summer and allowed to decay forms an excellent supply of soil organic matter to nourish watermelons grown the next year. In Florida and southern Georgia the watermelon crop is harvested in ample time for planting velvetbeans or cowpeas the same season.

PREPARING AND FERTILIZING THE SOIL

Although watermelons do not require much cultivation, the soil must be well plowed and harrowed before they are planted. On newly cleared forest land, both before and after plowing, remove most of the sticks, roots, and trash at the surface that interfere with cultivation. If small roots are brought to the surface in quantities during the final preparation of the soil, pile them around the stumps and either burn them or use them for some such purpose as filling gullies. If old land is in sod or has on it some such crop as velvetbeans, cowpeas, or clover, plow it either in the fall or at some time during the winter when the ground is in suitable condition. Early in the spring, disk the soil thoroughly and harrow or drag it in preparation for planting. The same general preparation required for corn or cotton fits the soil for watermelons.

In growing watermelons the amount and kind of fertilizer used should be determined by the type of soil and its previous cropping. Watermelons do best on soils well supplied with organic matter. This can be increased or maintained by plowing under soil-improving crops such as clover, cowpeas, or soybeans or by the application of manure when it is available at a reasonable cost.

Do not use manure as a fertilizer for watermelons where the bedding or hay is likely to have been produced on land where diseased melons have been grown recently. Hay from such fields often carries the fungi causing wilt and certain other melon diseases. These organisms can persist in the manure and be carried into the field and infest the soil. Manure known to be free from disease-producing organisms can be profitably used. It should be fairly well rotted and should be thoroughly mixed with the soil.

The best method of distributing manure depends on how much is available and how the watermelon seed is going to be planted. If the manure available does not amount to more than 3 or 4 tons per acre and the seed is to be planted in hills, work the manure into the hills. Where the crop is to be grown in continuous rows, scatter the manure in a furrow and throw a double furrow over it, forming a slight bed, or elevation, on which the seed is planted. If manure is available at more than 3 or 4 tons per acre, broadcast or scatter it in a strip along the row and disk it thoroughly into the soil. Even a small quantity of manure worked into the hills or furrows is decidedly helpful in producing strong early growth.

Since manure usually is not available in large quantities, most growers depend on commercial fertilizers to produce a crop. Even where some manure is used to start the crop it commonly is necessary to make a later application of a commercial fertilizer. Part of the fertilizer is applied in a strip along the row about one week before planting and thoroughly worked into the soil. After the vines begin to run they are often given one or more side-

dressings with a mixed fertilizer or with some form of nitrogen alone.

The amounts of fertilizer and the formulas used vary greatly with the locality and the soil. Florida growers commonly use 1,200 pounds per acre of fertilizer before planting. Growers in Georgia, Arkansas, and the other Southern States, most frequently use 600 to 800 pounds per acre. The analyses consist of 4 to 6 percent of nitrogen, 6 to 10 percent of phosphoric acid, and 4 to 8 percent of potash. After the vines begin to run, the plants are given one or two sidedressings of fertilizer. These may consist of one or two applications of 100 to 200 pounds per acre of a mixed fertilizer high in nitrogen and potash but without phosphoric acid; or one to three applications of 100 to 150 pounds per acre of sodium nitrate or an equivalent amount of nitrogen in some other form. This often is combined with 25 to 50 pounds per acre of muriate of potash.

In the Southwest most watermelon growers use a 5–10–5 mixture at rates of 200 to 400 pounds per acre. Many growers sidedress the plants with ammonium nitrate when the vines are about 18 inches long and sometimes make an additional application when the blooms appear.

In the Middle Atlantic States growers ordinarily use 500 to 800 pounds per acre of a 5–10–5 fertilizer before planting and sidedress with 200 to 300 pounds per acre of sodium nitrate or an equivalent amount of nitrogen in other forms when the runners start.

In the Central States the common practice is to apply 200 to 800 pounds per acre of a well-balanced mixture. Some growers mix a small amount of fertilizer with the soil in the hill before planting to give the plants a rapid start.

VARIETIES

The watermelon belongs to the botanical family *Cucurbitaceae*, which includes cucumbers, muskmelons, squashes, and pumpkins. Watermelon will not cross with any of these. All varieties of watermelon and the citron or preserving melon belong to the species *Citrullus vulgaris*.

In selecting watermelon varieties for planting, you should first consider the length of the frost-free period in your locality and the purpose for which the crop is grown. Use disease-resistant varieties if resistance is available in varieties that meet other requirements.

When watermelons are grown for local market or the home garden, eating quality is the predominant consideration. Some varieties of very high quality that will not withstand shipment are excellent for local use. Earliness, size, and yield also require consideration.

Melons for shipment must have a tough rind that will reduce breakage in handling and have a solid flesh of good quality. Consumer demand for better quality has led to the development of varieties having tender, crisp, sweet flesh, a moderate number of seeds, and little fiber. These characteristics have been combined with a thin rind that is firm enough to stand shipment. Some varieties are now available that are also resistant to fusarium wilt and anthracnose.

Watermelon varieties are so numerous that a complete listing here is impracticable. Brief descriptions of a number of desirable varieties are given as a guide in selecting varieties for shipping, local marketing, and home use. At

present (1962), the leading commercial varieties are Charleston Gray, Florida Giant (Cannonball), and Congo. Other important varieties are Dixie Queen, Blackstone, and various strains of Klondike, Peacock, and Garrison. The small "icebox"-type melons are a minor part of the commercial crop, but they are increasing in popularity. Further information on varieties best adapted to particular localities may be obtained from county agricultural agents and from local growers.

Baby Klondike.—About 92 days. Resistant to fusarium wilt. A small "icebox"-type melon developed for use in California. Fruit 8 inches long and 7 inches in diameter; blocky at ends. Even green, thick rind. Flesh deep red, slightly fibrous, of good quality. Tan seeds.

Blacklee.—About 90 days. Fusarium wilt-resistant shipping melon of good quality. Fruit medium large, cylindrical, very blocky; averaging 30 to 32 pounds. Dark-green, thin, tough rind. Flesh bright red, firm, sweet. Seeds medium-sized, black.

Black Diamond.—(See Florida Giant.)

Blackstone.—About 95 days. A new variety resistant to anthracnose but not to fusarium wilt. Popular for commercial shipping and home garden use in the Southern, Southwestern, and some Midwestern States. Fruit round, large, similar to Florida Giant, averaging about 35 pounds (fig. 1). Dark green, hard rind with yellow ground spot. Flesh bright red, crisp, sweet. Slightly earlier and higher in sugar content than Florida Giant. Seeds large, stippled black.

Charleston Gray.—About 85 days. Very resistant to anthracnose; resistant but not immune to fusarium wilt. The variety is most widely grown for shipment in Florida and the Southeastern States. Economically important

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FIGURE 1.—Blackstone watermelon.

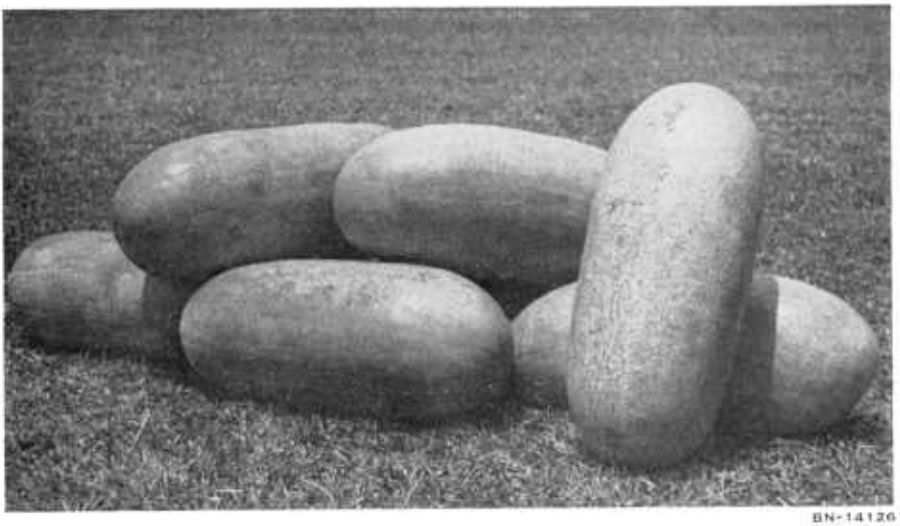

FIGURE 2.—Charleston Gray watermelon.

also in Texas, Arizona, and Midwestern States. Fruit long and blocky, of uniform size, weighing 28 to 35 pounds (fig. 2). Rind light grayish green with darker green veins, resistant to sunburn, relatively thin but very hard. Flesh bright red, crisp, sweet, of superior quality and flavor. Seeds black.

Citron.—About 95 days. Used only for sweet pickles, preserves, and candied fruits. Fruit round, 7 to 8 inches, weighing 7 to 8 pounds. Rind smooth, medium green, streaked with dark green, very hard. Flesh white, very firm, unpalatable when raw. Green- and red-seeded varieties exist.

Congo.—About 90 days. Resistant though not immune to anthracnose. Not resistant to fusarium wilt. An important shipping variety in Florida and the Southeastern States. Fruit large, semilong, thick, 30 to 35 pounds, with some fruits weighing 50 pounds (fig. 3). Rind

FIGURE 3.—Congo watermelon.

medium green with dark-green stripes, medium thick, very hard, tough; resists breakage in handling and transit. Flesh similar to that of Garrison, bright red, solid, crisp, sweet, excellent quality. Seeds light tan with black tips and sides.

Dixie Queen, Wilt Resistant.—About 85 days. Similar to original Dixie Queen but resistant to fusarium wilt. Used in the South for shipping and popular in home gardens. Fruits large, nearly round, averaging about 30 pounds, with some from 40 to 50 pounds. Rind light green with dark stripes that are not sharply outlined, thin, tough. Flesh bright red, crisp, fine-grained, very sweet. Seeds white, small.

Fairfax.—About 85 days. Resistant to anthracnose and fusarium wilt. A good shipping melon for the South. Fruit long, weighing 30 to 40 pounds. Rind light green with dark striping, hard, tough. Resembles Garrison, but stripes are darker and rind much tougher. Flesh of good quality. Seeds same color and size as Garrison but with black tips.

Florida Giant (Black Diamond, Cannonball).—About 90 days. A standard shipping variety in the Southeastern States and Texas. A high-yielding variety with good shipping quality, but inferior to some varieties in texture, flavor, and color of flesh. Fruit large, nearly round, commonly weighing 35 to 40 pounds, with some weighing 50 pounds. Rind very dark green, slightly ribbed, thick, tough, hard (fig. 4). Flesh red, rather coarse-grained, sweet, crisp. Seeds brownish black.

Garrison.—About 85 days. A high quality melon widely used for local markets in the South. Its tender rind makes it unsuitable to distant shipping. Fruit large, long, cylindrical, weighing 35 to 40 pounds, or more. Rind very pale green with heavy darker green stripes, very thin, tender. Flesh bright red, slightly granular, sweet, of superior quality. Seeds creamy white.

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FIGURE 4.—Florida Giant (Black Diamond, Cannonball) watermelon.

Garrisonian.—About 85 days. Resistant but not immune to anthracnose to which Garrison is susceptible. Resembles Garrison in size, shape, color and quality of flesh. Hard rind gives it better shipping quality than Garrison, but it is best adapted to local markets. Fruit long, typically weighing about 40 pounds. Rind light green with dark stripes, harder than that of Garrison. Flesh bright red, sweet. Seeds white with darker tips than seeds of Garrison.

Hawkesbury, Purdue Strain.—About 85 days. Resistant to fusarium wilt. Popular for local market in the Midwest and suitable for shipping. Fruit similar to Irish Gray, large, long, weighing 32 to 35 pounds. Rind light grayish green with deeper green veining, thin but tough. Flesh dark pink, of good quality. Seeds dark brown.

Hope Diamond.—About 90 days. Resistant to anthracnose

and fusarium wilt. Similar in appearance to Florida Giant (Black Diamond), but of superior quality. Rind dark green, tough. Flesh bright red, sweeter than that of Florida Giant. Seeds similar to Black Diamond.

Kleckley Sweet (Wondermelon).—About 85 days. A leading home garden and local market variety in the Midwest. Tender rind makes it unsuitable for shipping. Fruit large, cylindrical, often 20 to 22 inches long, weighing 30 to 35 pounds. Rind dark bluish green, thin, and tender. Flesh bright red, exceptionally sweet, tender. Seeds white with brown markings.

Kleckley Sweet No. 6.—About 85 days. Resistant to fusarium wilt. Used for local market and short distance shipping in Midwest. Fruit similar to Kleckley Sweet, large cylindrical, but slightly tapered. Rind dark bluish green, thin, tough enough for short distance shipment. Flesh similar to Kleckley Sweet, free from large, coarse veins. Seeds white.

Klondike, Black-Seeded.—About 85 days. A very popular early shipping and market variety in California. Fruit medium-sized, about 16 inches long and 10 inches in diameter, slightly furrowed lengthwise, ends flat. Average weight 25 pounds. Rind even dark green, very thin, tough. Flesh very dark pink, sweet, free from fiber, of fine quality. This black-seeded variety has largely supplanted the older brown-seeded variety.

Klondike R-7.—About 85 days. Resistant to fusarium wilt. Very valuable for planting on wilt-infested lands but less productive than wilt-susceptible type on wilt-free land. Similar to black-seeded and brown-seeded Klondike, but immature fruit show a distinct bloom and have less furrowing and rounder ends when mature. Fruit about 15 to 17 inches long and 8 to 10 inches in diameter. Average weight about 25 pounds. Seeds very small, brown, with black tips.

Klondike, Striped.—About 85 days. A popular market and shipping melon in California. Fruit medium large, oblong, thick, 16 to 18 inches long and 8 to 10 inches in diameter. Average weight 27 pounds. Rind light green with irregular dark-green stripes, medium thin, tough. Flesh scarlet, very sweet, excellent flavor. Seeds small, black-striped, splotched with brown.

Klondike, Striped, Blue Ribbon.—About 85 days. Wilt-resistant variety otherwise identical in type with Striped Klondike. Should be used on wilt-infested land. Slightly less productive than the non-resistant type on wilt-free soil.

New Hampshire Midget.—About 78 days. A very early, small, "icebox"-type melon. Popular in short-season areas for home garden, local market use, and local shipment. Grown to some extent in Texas and in Florida where fruit for distant shipment are harvested just before full maturity. Fruit 7 to 8 inches long and 5 inches in diameter, oval-round. Rind medium green with darker netting, thin, not tough. Flesh medium red, sweet, slightly fibrous. Seeds numerous, small, almost black.

Peacock, Improved.—About 90 days. An important shipping variety in California and Arizona. Fruit 15 to 17 inches long and about 10 inches in diameter, oblong with blocky ends, sometimes slightly furrowed. Average weight 25 pounds. Rind very dark green, thick, tough. Flesh orange red, crisp, firm, sweet. Seed small, brownish black to black.

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FIGURE 5.—Tom Watson watermelon.

Rhode Island Red.—About 86 days. Early "icebox"-type melon for the North; withstands handling well. Vigorous vines produce good yield of oval fruit weighing 8 to 12 pounds. Rind light green, striped with darker green, firm, medium thick. Flesh deep red, crisp, of fine texture and sweet. Seeds deep brown.

Stone Mountain.—About 90 days. A standard variety for home garden and local market in the South, where it also is used for shipping. Fruit large, almost round, weighing 30 to 40 pounds. Rind medium green, thin, fairly tough. Flesh bright red, of fine texture, very sweet. Seeds white with dark-brown tips.

Sugar Baby.—About 80 days. An early melon of the small "icebox"-type suitable for all but very short-season areas. Slightly later than New Hampshire Midget. Excellent for home gardens and local markets. Probably can be used for shipping. Fruit round, 7 to 8 inches in diameter, weighing 8 to 10 pounds. Rind medium green, thin, hard, tough. Flesh medium red, firm, crisp, sweet, of fine texture. Seeds relatively few, very small, dark tan mottled with black.

Tom Watson.—About 90 days. Popular variety in the South for shipping, local market, and home gardens (fig. 5). For many years a leading shipping melon in many sections, but it has gradually given way to varieties of better quality. Fruit large, long, cylindrical, weighing 35 to 40 pounds. Rind dark green with fine veining of darker green, medium thick, tough. Flesh deep red, crisp, rather coarse, sweet. Seeds brown.

Winter King and Winter Queen.—About 90 days. A home garden and local market variety whose fruit will keep for several weeks if stored at temperatures of 38° to 40°F. Fruit round, about 9½ inches in diameter, weighing about 15 pounds. Rind pale yellowish green with faint, light-green stripes, thin but rough. Flesh fine-textured, sweet. Seeds small, black.

Yellow Ice Cream.—About 88 days. A yellow-fleshed variety suited to home garden and local use. Fruit medium large, oblong, averaging 20 pounds. Rind deep green. Flesh bright golden yellow and very sweet, with a sugary flavor not found in other watermelons. Seeds brown.

Seedless watermelons. — Seedless watermelons are sterile, triploid hybrids that produce fruits with few or no true seeds. Japa-

nese scientists developed the method of producing them. One parent is a tetraploid, the other a diploid variety. A tetraploid variety is produced by treating watermelon plants with colchicine, a drug that causes a doubling of the usual diploid number of chromosomes in the plant's cells. Many of the resulting tetraploid plants must be produced and selected to find those with satisfactory capacity to combine with selected diploid parents. Pollen from the selected diploid plants is used to pollinate blossoms of selected tetraploid parents. Seeds from this cross have a triploid chromosome number. These seeds produce plants that bear the seedless melons. These melons have small, white, empty ovules in the flesh but these are not true seeds.

The complex process involved in producing these triploid seeds makes their cost very high. It is not usually practical to plant them directly in the field because the soil must be warm for good germination and have an average temperature above 68° F. The common practice is to sprout them indoors at temperatures from 82° to 86° F. The seed can be sprouted between layers of moist paper toweling or in moist sand.

When the seeds sprout, they are planted in plant bands filled with greenhouse potting soil or well-rotted manure. Some growers place the seed on top of the soil or manure in the bands and cover it with soil. The bands are held in hotbeds or in the greenhouse at 85° F., until the seedlings emerge. As soon as this occurs, the temperature is lowered to prevent too rapid growth of the seedlings. The hotbed sash is removed in mild weather and the plants given ample ventilation. When the plants have two or three well-developed leaves they can be transplanted in the field. Care is used not to break the roots, and the plant bands are removed unless they are of a type designed to be left in the soil.

Seedless watermelons do not set fruit unless the triploid plants are pollinated from an ordinary commercial variety (diploid plant). There must be one diploid plant to every five to eight triploid plants. The diploid plants are staggered among the triploid plants in such a way that every triploid is adjacent to one diploid plant. Always use a diploid variety whose fruit is easily distinguished from that of the seedless melon. The plants are cultivated and fertilized in the same way as ordinary commercial varieties.

As yet, seedless watermelons have not been widely grown, but it appears that an excellent market for them could be developed. Most hybrids now available have fruits that are round and weigh from 8 to 10 pounds. The rind is thin, fairly tough, striped. The deep-red flesh is sweet, crisp, of excellent texture. The yield of melons is about equal to that of standard commercial varieties. Seedless melons have not shown resistance to any of the common watermelon diseases.

PLANTING AND THINNING

Poor seed often is responsible for low yields and failures of watermelon plantings. High-grade watermelon seed can be produced rather easily, and growers should always be sure that their seed comes from a reliable source.

A pound of watermelon seed is enough for an acre where hill plantings are made. Continuous row plantings require more seed.

Watermelon seed does not germinate well when soil temperatures are below 70° F., and field

planting should wait until the soil is warm. Young plants are easily injured by frost. A warm, frost-free period of 4 months is needed for successful watermelon production, unless plant protectors are used or the plants are started in heated beds. In southern Indiana growers commonly start their plants in plant bands. These are filled with well-rotted manure that is tamped to give a firm surface. The bands are placed in hotbeds and are usually fumigated before the seed is planted.

Watermelon planting begins in southern Florida during late December or early January, in southern Georgia during March or early April, and in the more northerly commercial watermelon-producing sections within the period May 10 to 20. To reduce probability of loss of early plantings from frost, many growers make an additional row planting about 5 days after the first, sowing the seed 3 to 5 inches from those of the original planting. The use of plant protectors can be valuable with very early plantings in Florida.

Planting distances vary little among different commercial watermelon-producing localities. In the Southeast the 10- by 10-foot spacing is perhaps the most popular, but a few growers plant as closely as 8 by 10 feet or as widely as 10 by 12 feet. If rows of hills are placed 12 feet rather than 10 feet apart, cultivation can be continued longer in one direction and spraying with power sprayers can be done more easily. Texas growers plant at distances averaging 12 by 12 feet with about 300 hills per acre. Where melons are planted in continuous parallel rows, the rows are spaced 14 to 20 feet apart.

Hills should always be lined up in both directions, in order that the crop may be cultivated both ways during the early part of the season.

For planting watermelons, harrow the ground so as to leave a level surface, or work it so that a slight ridge is formed where the seed will be planted. This ridge provides good drainage on land where heavy rains may damage the young plants. For hill plantings, mark the rows and then crossmark to show the spacing of the hills in the row. Crossmarks also serve as a guide for putting manure or fertilizers at the hills. Plant the seed about 1 inch deep at the crossmarks. Plant six or seven seed by hand in a hill and cover with the hand or a hoe. When seed is planted in a continuous row, a drill is used and the land is not crossmarked. This method requires more seed than hand planting.

About 10 days are required for the seed to germinate. When there is no great danger of loss of seedlings from insect injury or disease, start thinning the plants soon after they come up. At the first thinning leave three or four of the most vigorous plants in each hill. Later, reduce the number to one or two per hill. In row plantings leave a single plant every 6 to 8 feet. At the second thinning, remove plants by cutting them out; pulling the plants is likely to disturb the roots of those that remain.

The best yields of high-grade melons are likely to be obtained where hills are spaced at least 10 by 10 feet and the plants thinned to 1 plant per hill. This spacing gives about 360 hills per acre and should yield a total of about 700 melons per acre, with about 450 to 500 marketable melons.

CHEMICAL CONTROL OF WEEDS

High yields of high-quality watermelons can be obtained only

if weeds are effectively controlled. The cost of controlling weeds has always been one of the major items in the total cost of producing this crop. Effective herbicides have reduced the cost of weed control in watermelons.

Preemergence applications of N-1-naphthylphthalamic acid (sodium salt) [NPA], at 2 to 3 pounds in 20 to 40 gallons of water per acre on light sandy soils, 3 to 4 pounds on loam soils, and 4 to 6 pounds on clay and muck soils are effective in controlling weeds that germinate and emerge with the crop. The herbicide should be applied immediately after planting for control of these early-season weeds.

Applications of NPA 4 to 6 weeks after emergence, at the rates suggested above, will effectively control weeds that germinate when growth of the watermelon vines prevents close cultivation. NPA kills germinating weeds only, and established weeds must therefore be removed by cultivation or handweeding before the herbicide is applied.

Soil moisture and temperature levels suitable for quick weed seed germination are necessary to insure successful results with NPA.

CULTIVATION

If weeds are not controlled chemically, begin cultivation of watermelon plants within a few days after they emerge. Where the hills have been carefully checked, the land can be cultivated several times with only a little handwork needed close to the hills. As a rule, three or four general cultivations are sufficient. Later, as the vines spread, it will not be possible to cultivate in both directions.

Training the vines in well-defined rows makes it possible to continue cultivating in one direction until the melons are two-thirds grown. Train the vines before the fruit is set; moving the vines after fruit set may cause the fruits to drop. Remember that the watermelon is a rather shallow-rooted plant and that the roots often spread out farther than the vines. For this reason cultivation must be shallow, especially near the hills and after the vines begin to run freely.

FRUIT THINNING OR PRUNING

Growers frequently remove some of the young melons from the vines in order to increase the size and insure good shape and quality in those remaining. The word "pruning" as used in connection with melon growing means removing misshapen melons and otherwise reducing the number on each vine, not cutting back the vines. Any cutting back of the vines will interfere with the proper development of the melons.

The common practice in "pruning" is to wait until there is a good set of melons on the vines, the largest being 3 to 4 inches long, and then remove all but two of the best melons from each vine. Sometimes three or four melons are left at the first pruning and the two best fruits left at a second pruning about a week after the first. Some of the smaller fruited varieties are not pruned so closely; four to six melons may be left on each vine. Prune only when the vines are dry, so as to avoid spreading the fungus that causes anthracnose (p. 18).

Some investigators believe that in early pruning only the badly shaped melons should be removed. After the first cycle of fruits is set, subsequent removal of fruits that set late may increase the size of marketable fruit of the first set. This recommendation is

based on evidence that an average of less than two fruits were matured when two, three, or four melons were left on each vine. However, the value of pruning can best be determined by local experience where the crop is grown.

INSECT ENEMIES AND THEIR CONTROL

Watermelons usually can be grown without much injury from insects, although there are many insects that will feed on this crop. Those most likely to cause damage are the melon aphid, cucumber beetles, cutworms, and leaf miners.

Melon Aphid

The melon aphid (*Aphis gossypii* Glov.) is a small, louselike insect that obtains its food by sucking plant juices (fig. 6). It feeds on the underside of the leaves, and its presence often is first shown by a slight curling or cupping of leaves. An infestation may start when a few winged females fly to melon plants from one of the aphids' other food plants. These females start new colonies, which can spread over the entire plant and throughout the field. In heavy infestations the leaves curl and lose color. The aphids also spread the virus of mosaic disease from plant to plant.

Apply demeton, Diazinon, malathion, parathion, or Phosdrin to control aphids.

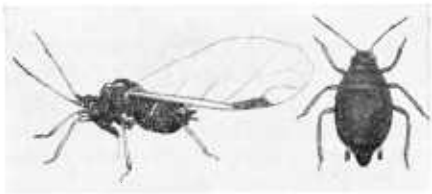

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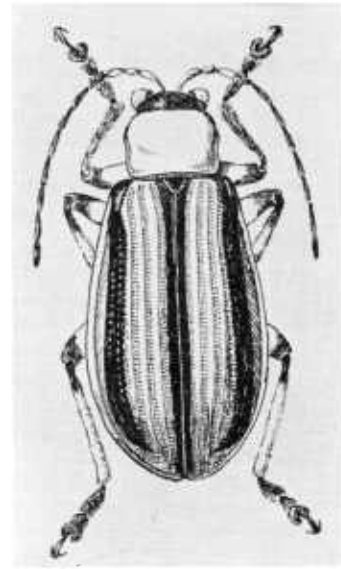
FIGURE 6.—Winged and wingless adults of the melon aphid greatly enlarged.

Cucumber Beetles

There are several kinds of cucumber beetles, and they vary in importance in different parts of the country. They are about $^{3}/_{16}$ inch long and greenish yellow with black stripes or spots. The striped cucumber beetle (*Acalymma vittata* (F.)) has 3 longitudinal black stripes down the back, whereas the spotted cucumber beetle (*Diabrotica undecimpunctata howardi* Barber) has 12 black spots (figs. 7 and 8). The other species are similar in appearance. The striped cucumber beetle is most abundant east of the Rocky Mountains. The spotted cucumber beetle sometimes becomes a menace to melons in the same areas. Both species occur in the South and Southwest, and in recent years a third species, the banded cucumber beetle (*Diabrotica balteata* Leconte), has become an important pest there; it is sometimes more numerous than the other two.



TC-7118

FIGURE 7.—The striped cucumber beetle.

based on evidence that an average of less than two fruits were matured when two, three, or four melons were left on each vine. However, the value of pruning can best be determined by local experience where the crop is grown.

INSECT ENEMIES AND THEIR CONTROL

Watermelons usually can be grown without much injury from insects, although there are many insects that will feed on this crop. Those most likely to cause damage are the melon aphid, cucumber beetles, cutworms, and leaf miners.

Melon Aphid

The melon aphid (*Aphis gossypii* Glov.) is a small, louselike insect that obtains its food by sucking plant juices (fig. 6). It feeds on the underside of the leaves, and its presence often is first shown by a slight curling or cupping of leaves. An infestation may start when a few winged females fly to melon plants from one of the aphids' other food plants. These females start new colonies, which can spread over the entire plant and throughout the field. In heavy infestations the leaves curl and lose color. The aphids also spread the virus of mosaic disease from plant to plant.

Apply demeton, Diazinon, malathion, parathion, or Phosdrin to control aphids.

TC-7097

FIGURE 6.—Winged and wingless adults of the melon aphid greatly enlarged.

Cucumber Beetles

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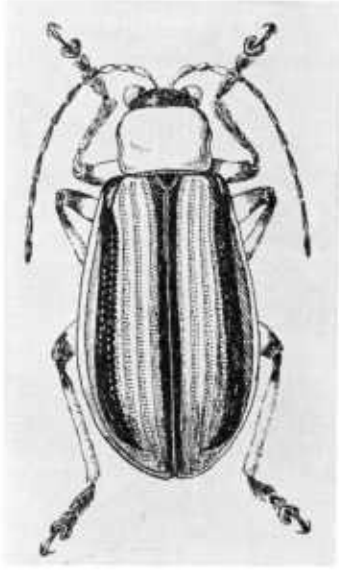

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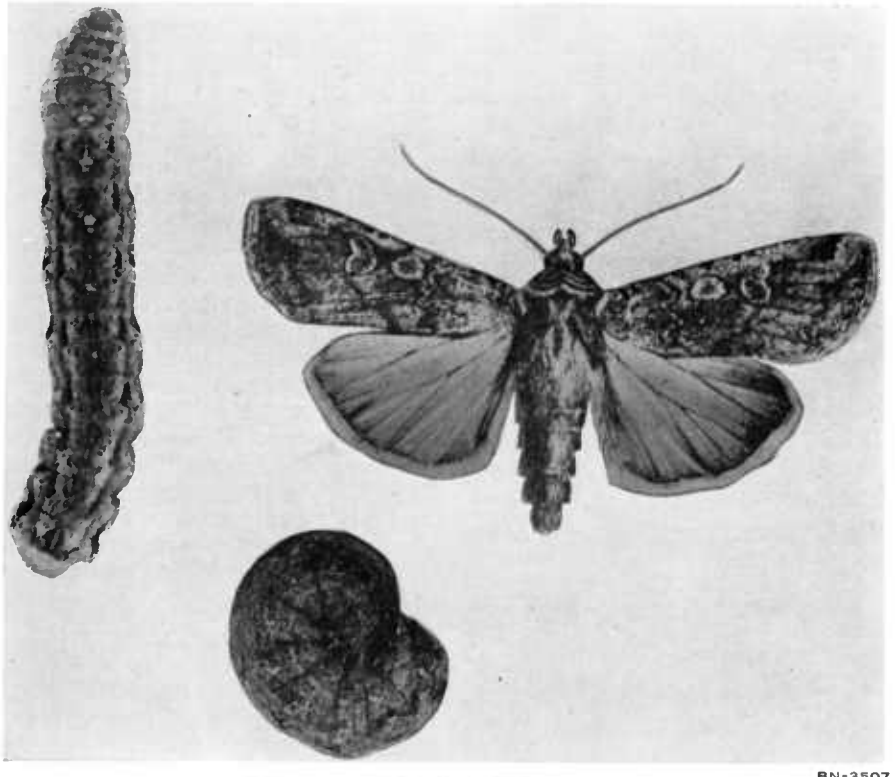
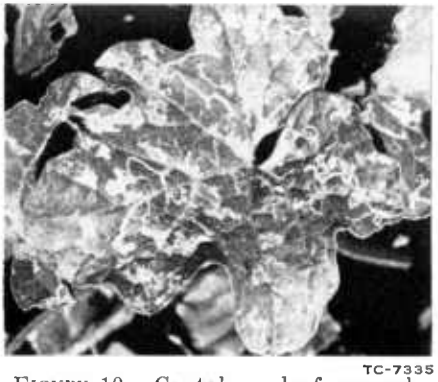
FIGURE 7.—The striped cucumber beetle.



BN-3507

FIGURE 9.—The variegated cutworm.

sifiable concentrates with water. From 20 to 150 gallons of spray per acre usually are needed for ground sprayers and 4 to 6 for aircraft sprayers. The amount of water applied does not appreciably affect the amount of active insecticide needed for insect control so long as suitable application equipment is used. Wettable powders, however, may clog nozzles of low-gallonage sprayers and are not recommended for application from aircraft equipment.



TC-7335

FIGURE 10.—Cantaloup leaf severely damaged by leaf miners.

The following tabulation gives the maximum amount of active ingredient of each insecticide that should be used per acre—smaller quantities may be adequate under some conditions.

Insecticide	*Pounds per acre* *In sprays*	*In dusts*
Demeton	1/3	—
Diazinon	1/2	1
Malathion	1 3/4	1 3/4
Methoxychlor	1 1/2	1 1/2
Parathion	1/4–1/2	1/4–1/2
Phosdrin	1/2	1/2
Toxaphene	9/10 (in bait only)	

Diazinon, malathion, and parathion are available in dusts, wettable powders, and emulsifiable concentrates, but parathion emulsions may cause slight injury to melon plants. Phosdrin is available in emulsifiable concentrates or dusts; methoxychlor in wettable powders and dusts; and demeton in emulsifiable concentrates. Toxaphene is also available in dusts and wettable powders, but these formulations injure melon foliage. Ready-mixed toxaphene bait is available.

To minimize losses of honey bees and other pollinating insects, make insecticide application, when possible, during late afternoon when these insects are not visiting the plants—avoid drift into bee yards and to other crops in bloom. These insects are necessary for good set of fruit and should be protected.

PRECAUTIONS

Insecticides are poisonous. Use them only when needed and handle them with care. They should be kept in closed, plainly labeled containers where they will not contaminate food or feed and where children and pets cannot reach them.

Follow all directions and heed all precautions given on the labels.

Parathion, Phosdrin, and demeton are extremely poisonous and may be fatal if swallowed, inhaled, or absorbed through the skin. They should be applied only by a person who is thoroughly familiar with their hazards and who will assume full responsibility for safe use and enforce precautions prescribed by the manufacturer.

Do not apply Phosdrin to watermelon within 14 days; parathion, methoxychlor, or demeton within 7 days; Diazinon within 3 days; or malathion within 1 day before a harvest. Do not apply toxaphene bait after the melons begin to form.

Diazinon and toxaphene can be absorbed directly through the skin in harmful quantities. Do not let them get on the skin, and keep them out of the eyes, nose, and mouth. If Diazinon or toxaphene is spilled, wash it off the skin and change clothing at once.

DISEASES AND THEIR CONTROL

Watermelons are generally subject to certain diseases that often destroy much of the crop. A grower who uses the right control measures, however, can prevent or greatly reduce losses from disease. The most important watermelon diseases are fusarium wilt, anthracnose, downy mildew, gummy stem blight, stem-end rot, mosaic, and root-knot.

The chemicals recommended for use in disease control are injurious to man and animals if taken internally; some of them are extremely poisonous. Follow all directions and heed all precautions given on the labels. Anyone handling them should take care to keep them from getting into his mouth, eyes, or nose. When chemicals are used in dust form, take care not to inhale them or to get large quantities on the hands or arms. When a chemical solution has been applied as a spray, pour out any part of it remaining unused in such a way that it will sink into the ground and not stand in puddles. After a spray solution is applied, wash all vessels used in preparing it and clean them thoroughly. Wash hands and clothing. Keep all the chemicals under lock and key or, at least, out of reach of children and animals.

Certain chemicals used for the control of watermelon diseases are referred to in this publication by coined common names,[2] as follows:

Common name	*Chemical name*
Captan	N-trichloromethylthiotetrahydro-phthalimide
Chloranil	Tetrachloro-*p*-napthoquinone
Maneb	Manganese ethylene bisdithiocarbamate
Nabam	Disodium ethylene bisdithiocarbamate
Thiram	Tetramethyl thiuram disulfide
Ziram	Zinc dimethyl bisdithiocarbamate
Zineb	Zinc ethylene bisdithiocarbamate

Anthracnose

Anthracnose has been one of the most common and destructive diseases of watermelon, but the recent introduction of resistant varieties has greatly reduced losses from the disease.

Anthracnose is caused by a fungus (*Colletotrichum lagenarium* (Pass.) Ell. & Halst.) that also attacks cucumber, muskmelon, and squash. Damage to the leaves and stems affects the vigor of the plants and reduces yields. Spotting and decay of watermelon fruits make them unmarketable. The disease is most prevalent in the Southern States, but may occur wherever there are periods of warm humid weather.

The fungus can attack the plant at any stage of growth, but the first symptom is usually noticed on older leaves. This consists of small irregular black spots that gradually enlarge (fig. 11). If the spots are numerous, the leaf finally shrivels and dies. When warm, moist weather favors rapid spread of the disease, a watermelon field may show so many blackened leaves that it looks as though burned. Under such conditions many fruits fail to ripen and many are likely to be sunburned. Under conditions less favorable to anthracnose, the older leaves are killed and the runners left bare near the center of the hill. Stems and runners

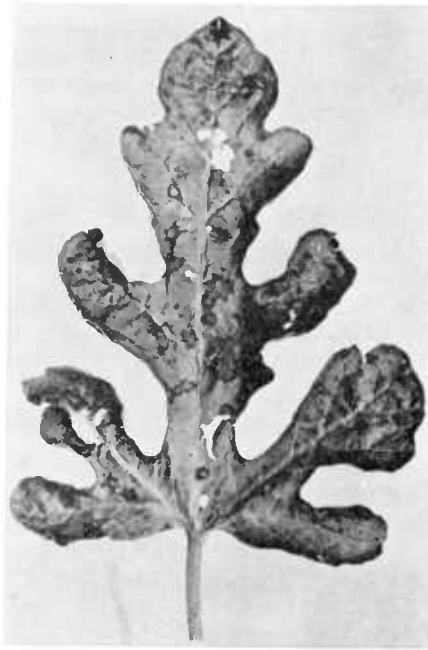


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FIGURE 11.—Watermelon leaf showing dark, irregular spots caused by the anthracnose fungus.

[2] These chemicals are marketed under various trade names such as Orthocide 50 Wettable and Stauffer Captan 50-W for products containing captan; Spergon for chloranil; Arasan 75, Thiram 75 W, Arasan SF-X, Roberts Thiram, and Chipman Thiram 75 for thiram; Dithane Z-78, Parzate Zineb Fungicide, Ortho Zineb 65 Wettable, and Parzate C Zineb Fungicide for zineb; and Ortho Ziram 76 Fungicide, Zerlate Ziram Fungicide, Zirberk, Karbam White, Orchard Brand Ziram, and Niagara Z-C Spray for ziram. (Use of trade names does not constitute a guarantee or warranty of the products named and does not signify that these products are approved to the exclusion of others of suitable composition.)

show long, narrow tan or black cankers. Some runners may be girdled and killed by these spots.

Melons infected when small show black spots similar to those on the leaves. Such fruits often become malformed. On older fruits the first symptom of the disease is small, raised spots with a dark water-soaked appearance. The centers of the spots become sunken and turn yellow (fig. 12). In moist weather the centers

BN-14129

FIGURE 12.—Watermelon severely spotted by the anthracnose fungus. The circular spots are slightly raised and have light-colored depressions in their centers, which often are covered with pinkish masses of the fungus spores.

of the spots on fruit may be covered by pinkish masses of spores of the fungus. Less often, such spore masses appear on the spots on stems and leaves. The spots on the fruit slowly enlarge, sometimes to a diameter of an inch; their centers become black and may crack open. Many infected fruits become worthless in the field. If fruits showing the small raised spots of the early stage of the disease are shipped, they are likely to decay in transit, both because of growth of the anthracnose fungus and because other decay-producing organisms enter the fruits through these spots. Frequently, infection that was not evident at the time of harvest causes melons to become spotted during shipment.

The anthracnose fungus can live for at least 1 year on decaying plant refuse in the soil. Also, it is carried on seed. When the fungus has once started in a field its spores can be spread by wind, by raindrops splashing from leaf to leaf, or by drainage water flowing from one part of the field to another. If diseased vines are cultivated and handled when wet with rain or dew, the spores can be carried to healthy plants on field workers' hands or clothing or on farm implements. Because of this, the disease often spreads rapidly in a field after the first picking. In warm, wet weather fully developed spots may appear on leaves within 7 days after the fungus spores germinate; under such conditions the disease may appear throughout a field within a very short time.

Recommendations for Control.—Losses from anthracnose can be prevented or reduced by (1) using resistant varieties, (2) rotating the crop, (3) disinfecting the surface of the seed with chemicals, and (4) spraying or dusting the plants with suitable fungicides.

Since 1950, a number of anthracnose-resistant watermelon varieties have been introduced and widely grown in the South. Congo, the first of these varieties, is of high quality and moderately resistant to anthracnose. It is not resistant to fusarium wilt. Charleston Gray, which now is the leading variety in the South, is of high quality; has relatively high resistance to anthracnose, and is resistant to fusarium wilt. Fairfax, Garrisonian, and Hope Diamond are varieties of good quality with resistance to both anthracnose and fusarium wilt. Blackstone, a variety of the Florida Giant type, is resistant to anthracnose, but not to fusarium wilt.

Since the fungus can live for at least 1 year in the soil, watermelons should not follow watermelons, cucumbers, muskmelons, or squash in the same field. This

is particularly important when anthracnose-susceptible varieties are grown. The long rotation needed to reduce loss from fusarium wilt (p. 22) should free the soil of the anthracnose fungus. In areas where wilt has not occurred, it is best not to plant on land where watermelons or other cucurbit crops have been grown during the preceding 4 years.

Seed is often a source of the first anthracnose infection in a field, because spores from infected fruit are likely to lodge on the surfaces of seed when they are removed from the fruit. It is advisable, therefore, to give watermelon seed a disinfectant chemical treatment before it is planted. Seed can be effectively treated by soaking for 5 minutes in a 1 to 1,000 solution of bichloride of mercury (corrosive sublimate). This solution can be prepared in small quantities by using the blue tablets sold by druggists. Dissolving one of the tablets in a pint of water gives a 1 to 1,000 solution. Large amounts of solution are prepared by dissolving 1 ounce of the bichloride of mercury in 7½ gallons of hot water. In preparing the solution, glass, earthenware, enamel, or wooden vessels must be used, since bichloride of mercury corrodes metal containers. The solution must be cooled before it is used.

Seed to be treated is poured into a loosely woven bag until the bag is not more than half full. The seed is then immersed in the solution for exactly 5 minutes. It should be well stirred in the solution to insure complete wetting. After 5 minutes in the solution, the seed is removed and washed for 15 minutes in running water or in several changes of water. After being washed, spread the seed at once in a thin layer to dry. The same lot of solution must never be used for more than two lots of seed, and at least 1 quart of solution must be used to each pound of seed. If old bags are to be used in storing treated seed they should be dipped in the bichloride of mercury solution and then washed.

Remember that bichloride of mercury is very poisonous. See the warning on page 17.

In recent years the mercury soak treatment has not been generally used on watermelon seed, partly because of the slight retardation of germination caused by bichloride of mercury. Growers commonly depend on dust treatments with thiram (p. 18) or chloranil (p. 18) to disinfect the surface of the seed. These compounds also protect against seed decay in the soil, and seedsmen frequently treat their watermelon seed with one of them before offering it for sale. While most growers depend on thiram or chloranil for seed disinfection, the bichloride of mercury soak treatment probably is more consistently effective.

Seed treated with bichloride of mercury is not protected against decay in the soil. If such protection is necessary, the seed should be treated with one of the abovementioned dusts at a rate of 0.3 percent by weight of seed. Use a can with a tight cover; fill it half full of seed; add the dust and shake well until all the seeds are well-coated with dust. The excess dust is then screened off and the seed is ready for planting.

In some sections in the Southeastern and Middle Atlantic States the use of resistant varieties has given adequate control of anthracnose without the application of fungicides, and spraying or dusting is not a common practice. In areas where fungicides must be used for control of downy mildew (p. 23) and gummy stem

blight (p. 24), the materials most commonly used are also effective against anthracnose. When anthracnose-susceptible varieties are grown, it is safest to protect the plants with fungicides regardless of the prevalence of other leaf diseases.

The organic fungicide maneb and zineb (p. 18) are effective in controlling anthracnose and also are used to control downy mildew (p. 23) and gummy stem blight (p. 24). Fixed copper fungicides are not very effective against anthracnose, although they give good control of downy mildew. Zineb and maneb may be used alone or in alternating treatments. Spraying with such a combination of these two compounds has given good results in control of leaf diseases of watermelons. Zineb or maneb sometimes are used in alternating applications with a copper fungicide when both anthracnose and downy mildew must be controlled. Ziram (p. 18) also is very effective against anthracnose, but does not control downy mildew. Where the latter disease occurs, ziram can be used in alternating applications with a copper compound. It can also be used in a mixture of 1 part of ziram and 2 pounds of a fixed copper compound containing 50 percent copper.

If evidence of anthracnose is found on seedlings or small plants, begin spraying or dusting at once and continue at 7- to 10-day intervals until shortly before harvest. Where the disease is prevalent, it is safest to begin spraying or dusting when the runners form. The number of applications will vary with locality and weather, but ordinarily 4 to 7 applications at 7- to 10-day intervals are sufficient. Where downy mildew does not commonly occur and the weather is dry early in the season, it may be safe to delay applications of a fungicide until midseason, if the field is closely watched for the appearance of disease.

Fusarium Wilt

Fusarium wilt is one of the most common and destructive diseases of watermelon. It is caused by a fungus (*Fusarium oxysporium* f. *niveum* Snyder & Hansen) that is prevalent in the soil in most sections where watermelons are an important crop. The disease is usually most severe on light sandy soils, and it develops most rapidly at temperatures of 75° to 85° F. When the soil is heavily infested by the fungus, plantings of susceptible varieties of watermelon are likely to be entirely destroyed.

Watermelon plants may be affected by the *Fusarium* fungus at any stage of growth. If a young seedling becomes infected, its seed leaves droop, it wilts, and within 1 or 2 days it dies. If a plant that has put out young runners becomes infected, the entire vine may suddenly wilt and die, or at first there may be wilting only during the day and some recovery at night. Older plants may become completely wilted within a short time (fig. 13) or may first appear stunted and later show symptoms of wilt. Sometimes one runner of an infected plant wilts before the rest of the plant shows any outward sign of disease. If the stem of the plant is cut lengthwise near the ground line, its woody portion shows a characteristic brown discoloration, sometimes almost black. In late stages of the disease a white growth of the fungus may appear on the surface of the stem near the ground line.

The fungus enters the plants through the small roots and concentrates its growth in the water-conducting vessels of the root and

M-4139

FIGURE 13.—Watermelon plant in a late stage of fusarium wilt. The leaves have wilted and are about to wither and die.

stem. The damage to these vessels results in the wilting and eventual death of the plant. When once introduced into the soil, the fungus can persist for many years and successive plantings of watermelons soon result in a heavy infestation of the soil. The fungus can be spread from field to field in soil carried on farm tools or the feet of farm animals, or in drainage water. It occasionally is carried on the seed and its spores can be carried by the wind. It can live in the soil for 10 to 15 years even when melons are not being grown. The form of the fungus that attacks watermelons does not attack related crops such as cucumbers, muskmelons, or squash.

Recommendations for Control.—Since the wilt fungus enters the plant through the roots, spraying or dusting will not control it. Crop rotation is the only means of control if susceptible varieties are grown, and rotation also is important when resistant varieties are used. Because the fungus can live for 10 to 15 years in the soil, rotation alone does not assure freedom from the disease. However, after 8 to 10 years susceptible varieties can be planted again for one season without much danger of severe injury. The best way to avoid loss from wilt is to use varieties with sufficient wilt resistance to produce satisfactory crops on infested soil. However, it is safest to allow at least 4 years between plantings of resistant varieties on the same land.

Wilt-resistant varieties are not necessarily immune to the wilt fungus, and the resistance of a variety may vary with the locality and the severity of infestation of the soil. In regions where "new" land is not generally available and long-term rotation is not always practicable, soils are likely to be generally infested with the fungus. In such areas, varieties that show satisfactory resistance in other regions or on lightly infested soil may not be satisfactory. The differences may be due in part to differing soil and climatic conditions or possibly to the existence of more than one race of the fungus. Local experience is a valuable guide in the selection of a variety.

The list of varieties with marked resistance to fusarium

wilt includes types suited to all sections where watermelons are an important crop. In the South and Southwest, Charleston Gray is very popular, and in certain areas the varieties Blacklee, Wilt Resistant Dixie Queen, Fairfax, Ironsides, Miles, and Missouri Queen are also grown. In the Middle West, Purdue Hawkesbury, Kleckley Sweet No. 6, and some of the varieties mentioned above are popular. In California, Klondike R–7 is widely grown, and Blue Ribbon Striped Klondike and Baby Klondike also are grown on wilt-infested land.

Downy Mildew

Downy mildew is not so generally prevalent in watermelons as anthracnose or fusarium wilt, but causes losses in the South Atlantic and South Central States. The disease is caused by a fungus (*Pseudoperonospora cubensis* (Berkeley & Curtis) Rostowzew) that is also destructive on cucumber, muskmelon, squash, and pumpkin in the Atlantic and South Central States. This fungus attacks only the leaves of the plant. The disease usually does not become very severe until midseason.

The first symptom of downy mildew is yellowish spots on the older leaves. These spots are roughly circular and do not have clear-cut margins. Later they turn dark and are of irregular shape. At this stage they are easily mistaken for those caused by anthracnose (fig. 11) or gummy-stem blight (see fig. 14). The spots may be few or so numerous that they cause the leaf to shrivel and die. Severely damaged leaves curl upward and inward along the midrib so that the underside of the leaf is exposed. These leaves usually stand more erect than do healthy leaves. This symptom is characteristic only of downy mildew.

When downy mildew is prevalent, it can produce a scorched appearance of the foliage very similar to that caused by anthracnose. In such fields the two diseases may be confused, but where anthracnose is present, lesions are usually present on the stems. Lesions on stems do not occur in plants attacked by downy mildew.

The fungus causing downy mildew does not live in the soil and is not carried in the seed. However, in Florida it is present on some of its host plants throughout the year. The spores produced on the leaves are readily carried by the wind, and the fungus gradually is spread northward during the spring and summer. Spores are produced abundantly on the undersides of the spots on the leaves in cool or warm weather, and the fungus spreads very rapidly when rain or heavy dew is frequent.

Recommendations for Control.—The organic fungicides zineb and maneb, used either singly or in combination, as recommended for anthracnose (p. 21) are effective, but occasionally the fungicides cause some leaf injury if used throughout the season. As mentioned in the section on anthracnose, good results often are obtained by alternating applications of zineb or maneb with a fixed copper compound.

The timing and number of applications of fungicides varies, depending on the usual prevalence of downy mildew and the weather. When conditions favor mildew development throughout most of the season, growers may make from 10 to 12 applications at 5- to 7-day intervals, but this is not common practice in most regions. Five to seven applications at 7- to 10-day intervals usually are sufficient and, in some sections, three may be enough.

Gummy Stem Blight

Gummy stem blight, or black rot (caused by the fungus *Mycosphaerella melonis* (Pass.) Chiu & J. C. Walker), occurs in many of the Eastern and Central States, but the disease has been most consistently damaging in the Southeastern States. In the past it was considered secondary to anthracnose as a leaf blight and fruit spot disease of watermelons. The recent use of resistant varieties has so reduced losses from anthracnose that gummy stem blight now is the most important disease in Florida and some other areas where moist, warm weather favors its development and spread. Cucumber and muskmelon also are susceptible to the disease.

Seedlings frequently show symptoms of gummy stem blight on the cotyledons (seed leaves) and young stems. The cotyledons develop circular black or dark-brown spots about one-fourth to one-half inch in diameter (fig. 14). Young stems may be girdled by similar spots and the seedlings killed. At times the cotyledons wither and the growing point of the seedling dies. The first true leaves often are infected from the cotyledons and the tips of the young runners sometimes are killed. The spots on the cotyledons and young leaves may be confused with those of anthracnose, but the spots are slightly darker and have minute, black specks in their centers. These are the fruiting bodies (pycnidia) in which spores of the gummy stem blight fungus are produced.

BN-14130

FIGURE 14.—Watermelon cotyledons showing spotting caused by the gummy stem blight fungus.

When plants are infected while small, the fungus spreads out from the center of the hill and causes further leaf and stem infection. Leaves show reddish-brown spots of irregular shape that are somewhat similar in appearance to those characterizing anthracnose. The gummy stem blight spots can be distinguished by the presence of the tiny, black pycnidia, which are not produced by the fungus causing anthracnose. Gummy stem blight often causes serious defoliation of watermelon plants.

Infected stems develop elongated spots that appear water-soaked. These later become light brown and crack so that open cankers are formed. These cankers exude a reddish, amberlike gum that gives the disease its name.

Mature fruits frequently are infected in the field and develop dark spots that enlarge to a diameter of 1 to 3 inches during transit. The centers of the spots become black, and pycnidia develop on their surface. The spots remain smooth and firm for some time, but the decay eventually may extend through the rind to the flesh.

The fungus persists from one season to the next on the remains of infected vines in the soil and may possibly be carried on or in the seed. Warm weather and frequent rains favor the development and spread of the fungus.

Recommendations for Control.—Crop rotation is essential to good control of gummy stem blight. Spraying as recommended for downy mildew (p. 23) helps to reduce leaf and fruit infection, but is not effective in preventing infection of the stems. Seed treatment as recommended for control of anthracnose (p. 20) should be equally effective in destroying spores of the gummy stem blight fungus if they occur on the surface of the seed.

Stem-End Rot

Stem-end rot (caused by the fungus *Diplodia gossyina* Cooke) is chiefly a disease of watermelon fruits in transit, but the primary infection occurs in the field. The disease is most common in Southeastern United States, but may occur in most areas where watermelons are grown. In the past the losses from stem-end rot in Florida and other Southeastern States were often severe, but since 1950 the losses have been comparatively slight.

Only the fruits are affected. Infection takes place chiefly through the cut ends of the stem at time of harvest, but may also occur through slight wounds or other injuries to the rind of the fruit. When infection takes place through the stem, the first symptom is a browning and shriveling of the stem. The stems feel soft and hollow when pressed. In a short time decay of the fruit begins at the point of attachment to the stem. There is a distinct line between the sound and decayed part of the fruit. The decay advances rapidly and may progress 1 to 2 inches per day. As it progresses, the stem end turns dark and shrivels (fig. 15). When this

M-4142

FIGURE 15.—Portion of watermelon fruit showing shriveling and decay caused by stem-end rot.

occurs, the rind often is covered with a dark-gray growth of the fungus in which are the pycnidia where spores are produced.

The stem-end rot fungus can persist from year to year on remains of infected melon vines in the soil. It also may be present on old cotton stalks and cornstalks and the remains of certain weeds. In melon fields there is likely to be an early infection of the blossom-ends of imperfect melons, or on the cut stems of culls left in the field. Such melons are a major source of infection when fruits are harvested.

An uninjured melon on the vine is not susceptible to stem-end rot. When its stem is cut or its rind is broken, a small amount of sap collects on the injured surface. This sap is a very favorable medium for the germination of the fungus spores and for the entry of the fungus into the melon. Therefore, the chance of infection of harvested melons increases with the length of time the melons are exposed to infection after they are cut from the vine. In the field or in transit the fungus spreads from any decaying melon to healthy ones through untreated cut stems or injuries caused by careless handling in loading and by lack of ventilation, too much moisture, and high temperatures that favor development of stem-end rot in transit.

Recommendations for Control.—Watermelons can be protected from stem-end rot by careful harvesting, prompt removal of fruits from the field, and by treatment of the cut stems with a disinfectant paste in the field or at the time of loading. To avoid getting the fungus on your hands and knives and thus spreading it as you work, never handle or cut decayed fruits if you are cutting melons from the vines. Clip sound melons with the longest possible stems.

The treatment of the cut stems of watermelons is no longer a common practice, but it is a valuable means of reducing losses from stem-end rot to melons in transit. If the melons are collected in rows in the field, the stems can be treated there or at the point of loading for shipment by truck or rail. When treating them, cut the stem back to about 1 inch with a sharp knife. Make the cut clean and smooth. With a small brush, cover the freshly cut end of each stem with a paste containing copper sulfate (fig. 16).

Commercially prepared pastes are available. As of September 16, 1961, copper sulfate-starch paste was registered by the U.S. Department of Agriculture under the Federal Insecticide, Fungicide, and Rodenticide Act and the Miller Amendment to the Federal Food, Drug, and Cosmetic Act for use in treating the cut stems of watermelons if the pesticide is applied only to the cut stems.

Mosaic

The watermelon mosaic virus causes some damage to the watermelon crop in the Southwestern States and in southern Florida. It also causes serious losses of muskmelon and some damage to squash in the Southwest. The virus is transmitted by certain species of aphids that carry it from diseased to healthy plants in feeding. It is rarely, if ever, carried in the seed, but the virus can persist in certain weeds and some cultivated plants.

On watermelon, the virus causes a mild mottling of some leaves and a shortening of the internodes of the runner. If plants are infected when small, they are stunted and produce almost no fruit. Fruits that are nearly mature when the plant is

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FIGURE 16.—Treating freshly clipped watermelon stems to prevent stem-end rot in transit.

infected show no evidence of the disease, but small fruits are likely to be deformed and occasionally mottled. There are a number of strains of the virus, which may vary in the severity of their injury to watermelon plants. Mosaic virus is distinct from the common cucumber virus that causes severe loss of cucumber, muskmelon, and squash but mosaic does not seem to be very common or damaging on watermelons.

Recommendations for Control.—No watermelon varieties are resistant to the watermelon mosaic virus. It may be possible to delay or even prevent the appearance of the disease in the field by keeping down weeds around the field and by using insecticides to control aphids. Do not plant watermelons close to muskmelon, cucumber, or squash if it can be avoided.

Root Knot

Root knot is caused by minute eelworms, or nematodes (*Meloidogyne* spp., formerly *Heterodera marioni*), that attack the roots of watermelon and other vegetables in many parts of the country and produce swellings, or galls, on the roots (fig. 17). Aboveground symptoms are lack of vigor, even dwarfing, and wilting of the plants during the hot period of the day. Root knot is often very serious in the sandy soils of the South. Whenever possible, the watermelon grower should use land that is free of root-knot nematodes. As a measure for cleaning nematode-infested land to such an extent that it can produce watermelons profitably, grow one or more of the following crops on it 2 out of 3 or 3 out of 4 years in rotation with the watermelons: Small grains, hairy indigo, various crotalarias, and (in some localities) peanuts.

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FIGURE 17.—Roots of young watermelon plant showing swellings, or galls, produced by root-knot nematodes.

Root-knot nematodes can be controlled successfully by the use of nematocides. These are chemicals sold especially for control of nematodes and, since most are fumigants, are also often called soil fumigants. The ones most commonly used for watermelon soil contain either dichloropropene (D-D, Telone, Vidden), ethylene dibromide (Dowfume W–85), or dibromochloropropane (Nemagon, Fumazone) as the active ingredient. Inject nematocides into the soil at a depth of about 8 inches 2 weeks or more before planting.

Special applicators, which deliver a stream of the liquid nematocide behind a shank pulled through the soil, are used. The whole field may be fumigated by spacing the injection lines 10 to 12 inches apart, but for watermelons and other crops planted in widely spaced rows or hills, there is considerable saving of chemicals by the use of row applications, that is, application of a single stream of fumigant to the row where the seed is to be planted. Good root knot control and further saving of fumigant can be obtained by the use of spot applications, that is, by application of the fumigant to the marked hills only. This is most conveniently done with a hand applicator and is practical only for small areas.

Follow manufacturer's directions exactly in using nematocides, and also seek advice from local county agents or from State experiment stations as to the most efficient application methods and possible deleterious effect under local conditions. This is important, because variations in soils and climates may affect the action of the chemicals.

As of March 31, 1961, ethylene dibromide and dibromochloropropane were registered by the U.S. Department of Agriculture under the Federal Insecticide, Fungicide, and Rodenticide Act and the Miller Amendment to the Federal Food, Drug, and Cosmetic Act for use on soil to be planted to watermelons, with a tolerance of 75 parts per million of inorganic bromide, calculated as bromine. Nematocides containing dichloropropene were registered on a no-residue basis for application at rates of 120 to 202 pounds per acre on ordinary soils and 320 to 486 pounds per acre on muck-type soils, with 2 to 3 weeks allowed between treatment and planting, or until the odor of the chemical has left the soil. Further information on this subject can be found on the label of the nematocide to be used or can be obtained from your county agent or the manufacturer's representative.

Handling and Loading

Watermelons must be harvested at the right stage of maturity. They should be ripe enough to be sweet but not so mature as to be overripe. Vari-

Handle nematocides with extreme care. Avoid prolonged breathing of the fumes and do not allow the liquid to come into contact with the skin. If the liquid is accidentally splashed on clothing, remove the garment, including shoes or gloves, without delay, and do not wear the clothes again until washed, cleaned, or at least thoroughly aired for a day or two. Never, under any of the circumstances, take the risk of getting the material into the mouth. If splashed into the eyes, wash out with large quantities of water and consult a physician.

eties may differ in certain characteristics that indicate maturity. Experienced workers have various ways of determining maturity in watermelons. The most generally practical field test of maturity probably is the change in the color of the rind, especially that part of it in contact with the ground. This part of the rind changes from white to pale-yellow with maturity. However, the best test of ripeness is the cutting and tasting of a few melons taken at random from various parts of the field. If these are mature, it is likely that others of similar appearance will be also. Watermelon harvesters generally are quite expert in selecting ripe melons.

Cut watermelons from the vine with as long stems as possible. This allows the stems to be cut again if they are treated to prevent stem-end rot (p. 25). As the melons are cut, workers who follow the cutters carry them to the roadways. If roadways have not already been left for the passage of a sprayer, divide the field before harvest into sections of about 8 to 10 rows each. Lay aside the vines between the rows that mark the space between sections for the roadway.

The harvested melons are laid in rows on the ground or collected in piles. There is likely to be less bruising if all melons are laid on the ground, but if they are piled the piles should not be more than three fruits high. Handle the fruits carefully to avoid bruising and never drop them to the ground. The blossom-ends of long-type melons are particularly subject to bruising. Do not stand melons on end.

Melons are hauled from the field in trucks or trailers. A cushioning layer of straw at least 6 inches thick should be used on the truck bed, and the sides should be padded with burlap or canvas. When loading, no more than two men on the ground should pass melons to one man on the truck. The truck loader must be given time to place the melons in the truck and not be forced by the speed of passing to drop them down onto the load. Do not throw melons directly into the truck. Do not pile melons over five deep in the trucks, and the loaders should not walk or ride on the load. Carelessness and haste in harvesting and loading cause much avoidable external and internal bruising and cracking. The internal damage to the flesh of the melons is not visible at the time of shipment. Severe internal bruising causes a breakdown of the flesh, which seriously impairs the appearance of cut sections of the melons and the eating quality.

Watermelons generally are shipped in bulk with the exception of the small, round "icebox"-type of melon. These usually are handled in bushel baskets, fiberboard boxes, or other types of containers.

Thoroughly clean railroad cars or motortrucks used for shipping watermelons and bed them several inches deep with straw or some similar cushioning material

Line the sides with heavy paper to prevent rubbing or scarring the melons. Impact damage to the melons at the end walls of the car or truck can be reduced by cushioning the surfaces of these walls to the height of the load with excelsior pads, or 2 to 6 inches of straw, or hay stuffed behind burlap. Never place straw or other cushioning material between the layers of melons, because it interferes with ventilation of the load.

The traditional method of loading rail cars of melons has been the lengthwise method. Today (1962), only the round-type melons are exclusively loaded lengthwise in rail shipments. Rail shipments of long-type melons are loaded by both lengthwise and crosswide methods.

In the crosswise method the car can be loaded from both ends at the same time if desired. The first layer of melons is begun with a crosswise line of melons. The second layer is laid lengthwise from the end of the car and the third layer again starts with a crosswise layer. The crosswise line of melons at the ends of the alternating layers causes each layer of melons to be offset in relation to the layers just above and below it.

When loading is begun at both ends of the car at the same time, the two sections of the loads are brought together in the doorway simultaneously. Sometimes the space between the two sections will not take a stack of melons loaded lengthwise and, when this occurs, the space is usually filled with melons loaded crosswise.

Recent investigations have shown that some of the newer long-type melons are particularly subject to blossom-end bruising. This is reduced when the melons are loaded crosswise in the car or truck.

Long-type melons are loaded four layers high if they weigh over 20 pounds and five layers high if they weigh less. Round-type melons are loaded three layers high if they weigh over 20 pounds and four layers high if they weigh less, although higher loads have been successfully carried both on trucks and rail cars. Melons should be loaded directly into the railroad car or motortruck from the field trucks and passed carefully in at the car doors without dropping or bruising. The same care should be used in loading in the car. For further details on handling and loading, refer to Marketing Research Report 133, July 1956.

Shipping and Grading

Over 80 percent of the watermelon shipments move by truck. Rail shipments are used, to a greater extent, for longer distances. Shipments by rail are not generally refrigerated, as ventilation seems to be more important than refrigeration in the case of watermelons. Shipments by rail are made chiefly in ventilated box cars. Truck shipments are not confined to any special type of trucks.

Most wholesale trading in watermelons is conducted on the basis of United States standards as amended in 1954. Copies of these standards can be obtained from the Fruit and Vegetable Division of the Agricultural Marketing Service, U.S. Department of Agriculture, Washington 25, D. C. Most watermelon shipments by rail are inspected at shipping points and certified as to grade by licensed Federal-State inspectors. Some truckloads are inspected but most are not. Certificates issued show the melons' quality, condition, grade, and size. Federal inspection is available also in and near the larger market centers. The use of stand-

ards by growers and shippers has many advantages. As a basis for trading, it tends to establish confidence among buyers and sellers. The standards serve as a common language between the shipper and distant buyer and provide a basis for quoting prices that is generally understood throughout the industry.

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