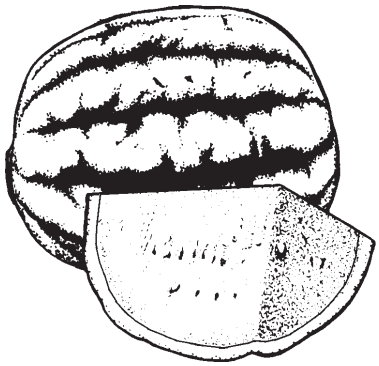
WATERMELON



BY
CHARLES W. MARR
NED TISSERAT

Watermelons are a popular summer crop and are well-adapted to growing in Kansas. Because watermelons are native to Africa, where they are used as sources of water in dry periods, they grow in periods of dry weather better than other vegetable crops. Commercial acreages of melons are grown in several areas of Kansas: the Kansas and Arkansas river valley and southeast Kansas. However, a potential exists for growing melons in most areas of Kansas, especially in south central and southwestern areas of the state.

LOCATIONS AND SOILS

Sandy or sandy loam soils are preferred for growing watermelons. Sandy soils generally warm faster in the spring, are easier to plant and cultivate, and allow deep root penetration. Watermelon is one of the deepest-rooted of all vegetables. Heavier soils may be adaptable to watermelons, but avoid low, damp areas or pockets where cool air may collect. A small trial plot should be planted first. Use an area where watermelons were not grown the previous year, if possible. Soil pH can vary from 5 to 8, so don‘t be concerned with adjusting soil pH.

VARIETIES

Several varieties of watermelons can be grown in Kansas. Local market preference, earliness desired, size and shape, disease resistance and vine vigor all need to be considered, but two factors are especially critical. First, grow varieties that your local market demands. There tend to be strong consumer preferences, so choose a variety that will meet this, but always plant some additional trials of several other varieties to test local demand and introduce new varieties. Second, choose a variety with anthracnose resistance if possible. Most new varieties have disease tolerance to anthracnose, a serious disease problem.

Both standard and hybrid (HY) varieties are available. Many newer varieties are hybrids. Hybrid seed is considerably more expensive, but may be worth the added investment.

Crimson Sweet. Developed at K-State; 25-pound average; round, striped fruit are finely textured and sweet; resistant to some strains of anthracnose and Fusarium wilt.

Blackstone or “Improved” Black Diamond. Several strains of the old Black Diamond variety are available. Improved strains such as Florida Giant and Diamond King (HY) have some anthracnose tolerance but are susceptible to Fusarium Wilt. They are smaller, more uniform, round with dark green color and have coarse red flesh.

Charleston Gray (Improved). Several strains such as Charleston Gray 133, Calhoun Gray, Sweet Charlie and Sweet Princess have improved disease resistance or more uniform size and shape; long-fruited, light green in color; won’t sunburn easily. Some of these varieties may be slightly to highly resistant to Fusarium wilt and tolerant to some strains of the anthracnose fungus.

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Jubilee. A popular southern variety with slight resistance to Fusarium wilt, tolerance to anthracnose and a long, striped fruit.

Oasis (HY). Deep red flesh, slightly earlier than Crimson Sweet; striped and slightly oval in shape; tolerant to anthracnose.

Starbrite (HY). Deep red flesh, striped, oblong shape, matures with Crimson Sweet.

Madera (HY). Red flesh, round striped, slightly earlier than Crimson Sweet.

Blue Bell (HY). Early, round, dark green; best of the early varieties; small fruit size (15 pounds). Reportedly resistant to Fusarium wilt, although some tests indicate it may be susceptible.

Royal Sweet (HY). Long, striped, good flavor, bright red flesh.

Royal Jubilee (HY). Long and blocky, striped, later maturing variety, improved Jubilee type.

ICEBOX OR SMALL MELONS

A limited market exists for small melons, especially in urban areas where their smaller size and ease of carrying or storing them is useful to some consumers.

Sugar Baby or Sugar Doll. Early, small size (8 to 10 pounds), dark green, round. Reportedly resistant to Fusarium wilt, although some tests indicate it may be susceptible under certain conditions.

SEEDLESS MELONS

Although seed is expensive and often emergence or vigor are less than other melons, a premium market for seedless melons can be developed. King of Hearts, Tiffany, or Crimson Trio are the most common seedless varieties. Many new seedless varieties are being evaluated. Because of erratic and poor germination in the field, transplants of seedless melons are suggested.

Seedless watermelons require a standard variety planted nearby for a pollenizer. The usual practice is to plant one row of standard melons between two to three rows of seedless.

SOIL PREPARATION AND FERTILIZATION

Soils should be plowed or tilled, disked and harrowed to make a fine seed bed. In very sandy areas where blowing sand may damage vines, planting strips in a winter cover crop of wheat, oats or rye may provide some wind protection. Watermelons require nitrogen, potassium and calcium. A soil test will indicate the soil levels of phosphorus (P), potassium (K), and a general indication of calcium. Nitrogen (N) should be added each year as it is readily leached or washed from the soil.

Apply P and K as indicated by the soil test recommendations. A moderate application of nitrogen, 50 to 70 pounds, will produce good yields without excessive vine growth. Many growers use a 1-2-0 or 1-1-0 ratio fertilizer at planting with 25 to 30 pounds of N per acre and add another 25 to 30 pounds of N later as side dressing (see below). More efficient use of fertilizer is achieved if applied in a band 3 or 4 inches to the side of the row and below the seed.

Side dressing. Adding an additional quantity of nitrogen is beneficial when vines are 8 to 12 inches long. Use soluble fertilizer, such as urea or ammonium nitrate, to give 25 to 30 pounds N / A.

PLANTING DATES

Watermelons are a warm-weather crop that grow poorly at cool temperatures. Earlier plantings are desirable to have fruits ready for market early, but planting before the average frost date, April 15 to 20 in most of eastern and central Kansas, is risky. Most plantings in these areas should begin about May l to 7, but in some years replanting may be necessary. For expensive hybrid seed or “seedless” varieties, wait until frost danger has passed and soil temperatures are warm. Most sandy soils warm quickly as warmer weather develops. Soil temperatures should be at least 60°F.

TRANSPLANTS

Some growers attempt to gain an earlier harvest by starting transplants in a hotbed, coldframe or greenhouse. Use plastic cells 1½ inch or larger or peat pots so little root injury occurs at transplanting. Start seeds 10 to 14 days before field setting

so melons have two to three true leaves when transplanting. Covering transplants with hotcaps or hot tents will also encourage earliness and provide frost and wind protection for tender transplants. Hotcaps should be "vented" by cutting a slit in them to allow ventilation on hot, sunny days.

Gradually, enlarging the opening will allow an adjustment to the outside environment by the tender melon plants. Water each plant with a "starter solution" using 2 pounds high phosphate, soluble fertilizer per 50 gallons of water. Use 1 cup around each plant.

SPACING

Spacing depends on the varieties of melons grown. Rows should be 9 to 12 feet apart with plants 3 to 6 feet apart in the rows. Many growers feel that 36 to 40 square feet of space per hill is necessary, but others feel 48 to 50 square feet per hill will produce better yields or larger fruit. Small icebox types of melons will require rows 5 to 6 feet apart, with 2- to 3-feet spacing in rows. Distance between rows can be adjusted to adapt to cultivation equipment. If black plastic mulch is used, a wider row spacing—11 to 12 feet—will require less plastic per acre, with a slightly closer spacing in rows to make up for the wider rows.

Plant two or three seeds per hill to ensure at least one healthy, vigorous plant. *Seeding rate:* 1 to 2 pounds per acre for large seed; ½ to ¾ pound per acre for smaller seeds, such as Crimson Sweet. *Planting depth:* ½ inch.

PLASTIC MULCH

Black plastic absorbs heat and warms the soil for earlier melon production. A seven- to 10-day earlier harvest is possible in most years. The mulch prevents weed growth, reduces evaporation of soil moisture, and lessens nutrient losses from leaching. Mulches are applied with a mulch applicator that rolls out and covers the mulch between two trenches and stretches it tight. Consult K-State publication for plans for a mulch-laying machine. Commercial mulch applicators are also available. Plants or seeds are then planted through the mulch with a small trowel or "bulb planter" used to punch a hole in the plastic. Mechanical "punch" planters are available to set plants through plastic mulch.

IRRIGATION

Melons are drought tolerant, but adequate water earlier in the season improves vine growth and yields. A critical time in determining yield potential is when first blossoms appear, so adequate water at this time is important. Apply water infrequently, but thoroughly wet the soil to a 2- to 3-foot depth. Avoid irrigation after fruits are near full size. Watering during the ripening season may delay harvest, cause splitting and reduce sweetness. Watermelons are well-adapted to drip or trickle irrigation as well.

WEED CONTROL

Since melons are widely spaced, planted late and develop a poor crop canopy, weeds are a serious problem. Cultivation between and within rows can be done by cultivation equipment if hills are cross-spaced. Herbicides offer benefits, but are sometimes variable in providing weed control under different seasonal conditions. Herbicides should be used according to label directions. Below are commonly used materials.

WATERMELON DISEASES

Anthracnose

Anthracnose, incited by the fungus Colletotricum lagenarium, is the major foliage disease of watermelon in Kansas. The disease

Alanap & Prefar mix	3-6 qt 4-6 qt	before planting & incorporate; watering helps	broad spectrum control of both broadleaf & grass weeds
Prefar	4-6 qt	before planting & incorporate	effective on grasses, some broadleaf
Alanap	3-6 qt	before planting & incorporate	effective on grasses, some broadleaf
Dacthal	8-11 lb	before planting & incorporate	lasts only 4-5 weeks
Curbit 3E	3-4 pt	on soil surface within 2 days of seeding	needs ½ inch irrigation or rainfall within 1 week

also affects cucumber and muskmelon, but is not a problem on squash, pumpkin or gourd. Anthracnose is most severe during relatively warm periods with frequent rainfall and a high relative humidity.

Symptoms of the disease vary somewhat on the host plant. On watermelon, leaf spots first appear light yellow or tan, but soon turn black. The roughly-circular lesions expand rapidly during favorable weather conditions. Elongated lesions also may form on the petioles and stems, causing death of plant tissue beyond the lesion. Severely blighted plants appear scorched and unthrifty. The fruit also is affected by the fungus. Young fruits are either killed or become malformed. Larger fruits develop sunken, roughly circular lesions that are water-soaked. During humid weather, masses of pink to salmon-colored spores are extruded from fruiting structures in the center of the lesions. This spore matrix is visible during wet weather.

The incidence of anthracnose can be reduced through the use of clean seed and crop rotation. Rotation periods should not be shorter than three or four years because the fungus can survive in crop debris. Many watermelon cultivars are resistant to the common race of the anthracnose fungus and these should be used whenever possible. The use of resistant cultivars does not necessarily preclude the possibility of anthracnose development. Resistance may be overcome by variation in the virulence of the pathogen. Check fields regularly for anthracnose or other foliar diseases. Susceptible varieties should be protected against infection during wet weather by fungicide applications. Sprays should begin as soon as symptoms appear and be continued on a seven-day schedule. For those watermelon varieties resistant to anthracnose, check the section on watermelon varieties.

Alternaria Leaf Spot

Alternaria leaf spot, incited by *Alternaria cucumerina*, is most common on muskmelons, but the disease also may occur on cucumbers, watermelon and other cucurbits. The disease tends to be more severe on weakened plants. Symptoms are first apparent on leaves nearest the center of the hill. Small yellow spots on the leaves enlarge rapidly, turn brown and often coalesce to kill large portions of the leaf surface. Dark concentric rings form within the lesions, resulting in a target-board appearance of the leaf spot. Defoliation causes a reduction in plant vigor and exposes the fruit to sunscald injury. Alternaria leaf spot is often misdiagnosed as anthracnose. In general, Alternaria lesions have the typical bull's eye pattern while those of anthracnose do not.

Follow a three- to four-year rotation and start with clean seed. Because the fungus tends to attack weakened plants, it is important to maintain optimal growing conditions, including balanced fertility, uniform moisture and good soil texture. Fungicides listed for the control of anthracnose (with the exception of benomyl) also will control Alternaria leaf spot. See the table for specific chemical and rates.

Downy Mildew

Cucumber and muskmelon are the most susceptible of the cucurbits to downy mildew, incited by the fungus *Pseudoperonospora cubensis*, but the pathogen also attacks watermelon, squash, pumpkin, gourd and other cucurbits. Symptoms first appear as small, angular, yellow lesions on the upper side of the leaf. A white to purplish mildew may be observed on the lower side of the leaf during humid weather. As the lesions expand, their centers turn brown. Often the margins of diseased leaves curl upward. During favorable weather, leaf lesions coalesce and kill large areas of the leaf surface. This results in a stunting of the plant and a failure of the fruit to mature properly. In severe cases, the entire plant will die.

Downy mildew is an erratic disease in Kansas; it may cause significant damage one year and then not show up again for several more growing seasons. This is because the fungus does not overwinter in the state, and must be introduced into fields on infected transplants or by wind-blown inoculum carried in air currents from southern states. In addition, the fungus requires extended periods of wet weather and free water on the leaf surface for the infection process. A grower may expect a downy mildew outbreak when inoculum is present and when weather conditions are favorable for infection. Control of downy mildew is dependent on cultural practices, early detection and timely applications of fungicides. If transplants are purchased from another state or area, they should be checked carefully for any symptoms of downy mildew. **Do not plant any infected transplants.**

It is a good idea to inspect fields regularly for any evidence of downy mildew or other disease problems. Early detection is essential for the proper control of foliar pathogens. If weather conditions become favorable for the development of downy mildew, begin protective fungicide applications and continue on a four- to seven-day interval. Protective fungicides such as mancozeb and chlorothalonil also will protect the plants from other foliar diseases (anthracnose). Copper-based fungicides may be used for protective sprays but they can be toxic to certain watermelon cultivars. If downy mildew is already present in the field, it is advisable to use a systemic fungicide (metalaxyl) to arrest disease development. This type of fungicide will stop lesion expansion once infection has occurred. A combination of metalaxyl (systemic) plus mancozeb or chlorothalonil (protectant) has been shown to have a positive synergistic effect in controlling downy mildew.

Fusarium Wilt of Watermelon

Fusarium wilt is one of the most important diseases of watermelon. The host range of this pathogen (*Fusarium oxysporum* f. sp. niveum) is thought to be restricted to watermelon, although artificial inoculations indicate that summer squash also may be susceptible. The disease may affect plants in all stages of growth. Damping-off is common on young seedlings. Young plants may develop a soft, cortical rot which results in chlorotic leaves and stunting. The most common symptom on older plants is wilting. Generally, the wilting process begins in one or more laterals of the plant. The leaves become flaccid, wither and turn brown. Gradually, the wilting progresses until the entire plant is killed. Vascular discoloration often is associated with wilted vines. This is best seen by slicing vertically through a vine near the soil surface. A yellow-brown discoloration may be seen in tissue directly beneath the outer layer of the vine. A white fungal growth also may be formed at the base of the dead vines.

Because the fungus can survive in soil for as long as 10 years, it is often impractical to control the disease through crop rotation. The best way to control Fusarium wilt is the use of resistant varieties. Use only those cultivars with resistance in fields where wilt has been a problem. Look in the earlier section on varieties for more information about disease resistance.

Rates and waiting intervals for fungicides labeled for the control of anthracnose (AN), Alternaria leaf spot (ALS) and downy mildew (DN) are in the table on the following page.

WATERMELON INSECTS

Striped or spotted cucumber beetles (yellow and black in color) and melon aphids are the most serious insect pests. It is important to remember that bees are necessary to pollinate melons and serious damage can be done to bees if insecticides are not used properly. Bees pollinate early in the morning. Melon flowers close by mid-afternoon and remain closed all evening. Apply insecticides only when flowers are closed so no spray material will come in contact with the bees. **Never spray while flowers are open.**

Cucumber beetles and aphids usually are feeding on undersides of the leaves, so it is important to get spray materials to cover this side. This is usually done with pressure to cause movement of leaves, exposing all sides to the spray.

Chemical insect control measures include:

Cucumber beetles

- carbaryl (Sevin); no waiting interval; 50 WP, 2 lb: highly toxic to bees; 80 WP, 1.25 lb: may cause some injury to young tender transplants
- methoxychlor (Lannate); 3-day waiting interval; 1.8L, 2 pt
- methoxychlor; 1-day waiting interval; 50 WP, 4 lb
- endosulfan (Thiodan); 0-day waiting interval; 50 WP, 1–2 lb
- permethrin (Ambush, Pounce); 3-day waiting interval; see label
- malathion; 1-day waiting interval; 5 EC, 2 pt; see label

Aphids

- endosulfan (Thiodan); 0-day waiting interval; 50 WP, 1–2 lb
- malathion; 1-day waiting interval; 57% EC 1, .5 ps

Disease Control					
Chemical	**Rate Per Acre**	**Waiting Interval**	**AN**	**ALS**	**DM**
Chlorothalonil					
Bravo 500	2.25–2.75 pt	0	X	X	X
Bravo 720	1.5–2 pt	0	X	X	X
Bravo 75 WP	1.5–2 lb	0	X	X	X
Maneb 80 WP	1–2 lb	5	X	X	X
Mancozeb					
Dithane M45, DF, F-45	2–3 lb	5	X	X	X
Manzate 200, DF	2–3 lb	5	X	X	X
Penncozeb, DF	2–3 lb	5	X	X	X
Benomyl (Benlate) 50 WP	.25–.5 lb	0	X		
Copper Compounds		0	X	X	X
Label will vary with formulation and manufacturer.					
Metalaxyl					
Ridomil MZ58	1.5–2 lb	5			X
Ridodmil Bravo 8lW	1.5–2 lb	5			X

- diazinon; 3-day waiting interval; 50 WP, 1 lb; do not use more than twice per season
- dimethoate (Cygon, Defend); see label
- metasyotoxr; 7-day waiting interval; 2 SC, 2 pt; see label

BEE POLLINATORS

Usually native or local honeybees are sufficient to provide adequate pollination. Bees are not active during cloudy days or rainy weather. Check fields on warm, sunny mornings and if you see that few bees are present, a hive may be necessary. One good hive should pollinate 8 to 12 acres.

OTHER FRUIT DISORDERS

Bottle necked. Characteristic of long varieties and worse on some than others, this condition usually results from inadequate pollination and/or moisture stress.

Splitting. Excessive moisture following periods of dryness causes splitting, especially in round melons.

White heart or hollow heart. Varies with varieties. White heart is thought to be related to excessive moisture and nitrogen.

Sunburning. Dark green varieties sunburn badly. Striped or gray varieties seldom sunburn.

HARVESTING

One critical factor is how to determine ripeness. This is critical because sweetness does not increase after harvest (some softening and darkening does occur). A brown tendril or "curl" at the attachment of the fruit to the main vine is a fair indicator (some varieties may or may not be ripe). The loss of a hazy, velvet appearance of the fruit surface with a shiny, slightly rough surface developing, is also a fair indicator. The development of yellow coloration of the ground spot (where the melons lie on the ground) is a good indicator on many varieties. All of these methods, as well as experience, probably are necessary to be sure of ripeness. Thumping for a hollow sound is less effective in determining ripeness on firmer-fleshed melons.

Melons should be cut or carefully removed from the vine, leaving 1½ inches of the fruit stem attached to the fruit. This helps to reduce rotting or deterioration at the stem attachment during storage. Melons are usually stacked on trailers, trucks or in pallet boxes in the field. Avoid bruising, rough handling or walking on stacked melons. Rind toughness limits how high melons can be stacked, but 5 to 6 feet is usual. Provide shade or move the truck to a shady location. **Never store picked melons in the sun.**

STORAGE

Melons do not keep for long periods. They are best kept for two weeks or less. Old melons develop a dark, orange-colored flesh. The texture, sugar content, and flavor usually deteriorate. Refrigeration at 45° to 50°F is best for short periods of storage.

MARKETING

Melons can be sold to a variety of sources. Roadside stands, farmers markets, local markets or "shippers" all can be used. The demand for melons is greatest on hot summer days and slows after cooler weather approaches. Check with market sources well in advance of the season to determine market demands and quality standards. Don't overlook large group functions, picnics, community events and institutions as possible market outlets.

COSTS AND RETURNS

Prices for melons decline as the season progresses. Early melons (using hot caps and black plastic) usually offset the additional expenses required and help "set your market" (get established in the market early). Many growers use a small area of early melons for this purpose. Wholesale prices for early melons may be 10 to 12 cents per pound, while later melons sell for 4 to 6 cents per pound.

An estimated crop budget for watermelon estimates cost of production follows.

Fuel consumption is estimated at 1.5 gallons per hour of tractor time. Oil and lubrication is estimated at 15 percent of fuel cost. Repairs are estimated at $2.25 per hour of tractor time and $17 per acre for irrigation equipment. Fuel, repairs and taxes for a truck are not included as costs. Depreciation, interest on investment and insurance for a truck are included as costs.

COST-RETURN PROJECTION FOR WATERMELON PRODUCTION IN INTENSIVE MANAGEMENT

Variable costs/acre	*Total*
1. Fertilizer	$ 62.00
2. Seed, Transplants	80.00
3. Herbicides	25.75
4. Insectcides	15.00
5. Fungicides	0.00
6. Nematicides	0.00
7. Labor	350.00
8. Fuel and Oil	45.45
9. Repairs	86.75
10. Water	12.00
11. Utilities	0.00
12. Custom Hire	0.00
13. Plastic/Drip	260.00
14. Marketing	0.00
15. Other	8.00
A. Total variable costs	$ 944.95
Fixed costs per acre	
16. Interest (land, buildings)	60.00
17. Taxes (land, buildings)	10.00
18. Rent for rented land	0.00
19. Depreciation, machinery	75.00
20. Interest, machinery	45.00
21. Depreciation, buildings	12.50
22. Depreciation, irr. equipment	165.00
23. Interest, irr. equipment	99.00
24. Insurance	6.63
B. Total fixed costs	$ 473.13
C. Total costs	$ 1,418.08
D. Yield per acre (CWT)	250.00
E. Price per unit	9.00
F. Returns per acre	2,250.00
G. Returns over variable costs	1305.05
H. Returns over total costs	831.92
I. Variable costs per unit (CWT)	3.78
J. Total costs per unit (CWT)	5.67

COST-RETURN PROJECTION FOR WATERMELON PRODUCTION IN EXTENSIVE MANAGEMENT

Variable costs/acre	*Total*
1. Fertilizer	$ 64.25
2. Seed, Transplants	12.00
3. Herbicides	46.00
4. Insectcides	15.00
5. Fungicides	0.00
6. Nematicides	0.00
7. Labor	280.00
8. Fuel and Oil	38.81
9. Repairs	73.25
10. Water	12.00
11. Utilities	0.00
12. Custom Hire	0.00
13. Supplies	0.00
14. Marketing	0.00
15. Other	0.00
A. Total variable costs	$ 541.31
Fixed costs per acre	
16. Interest (land, buildings)	60.00
17. Taxes (land, buildings)	10.00
18. Rent for rented land	0.00
19. Depreciation, machinery	75.00
20. Interest, machinery	45.00
21. Depreciation, buildings	12.50
22. Depreciation, irr. equipment	165.00
23. Interest, irr. equipment	99.00
24. Insurance	6.63
B. Total fixed costs	$ 473.13
C. Total costs	$ 1,014.44
D. Yield per acre (CWT)	200.00
E. Price per unit	9.00
F. Returns per acre	1,800.00
G. Returns over variable costs	1,258.69
H. Returns over total costs	785.56
I. Variable costs per unit (CWT)	2.71
J. Total costs per unit (CWT)	5.07

About the authors: Charles W. Marr is an extension horticulturist, vegetable crops; Ned Tisserat is an extension specialist, plant pathology.

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