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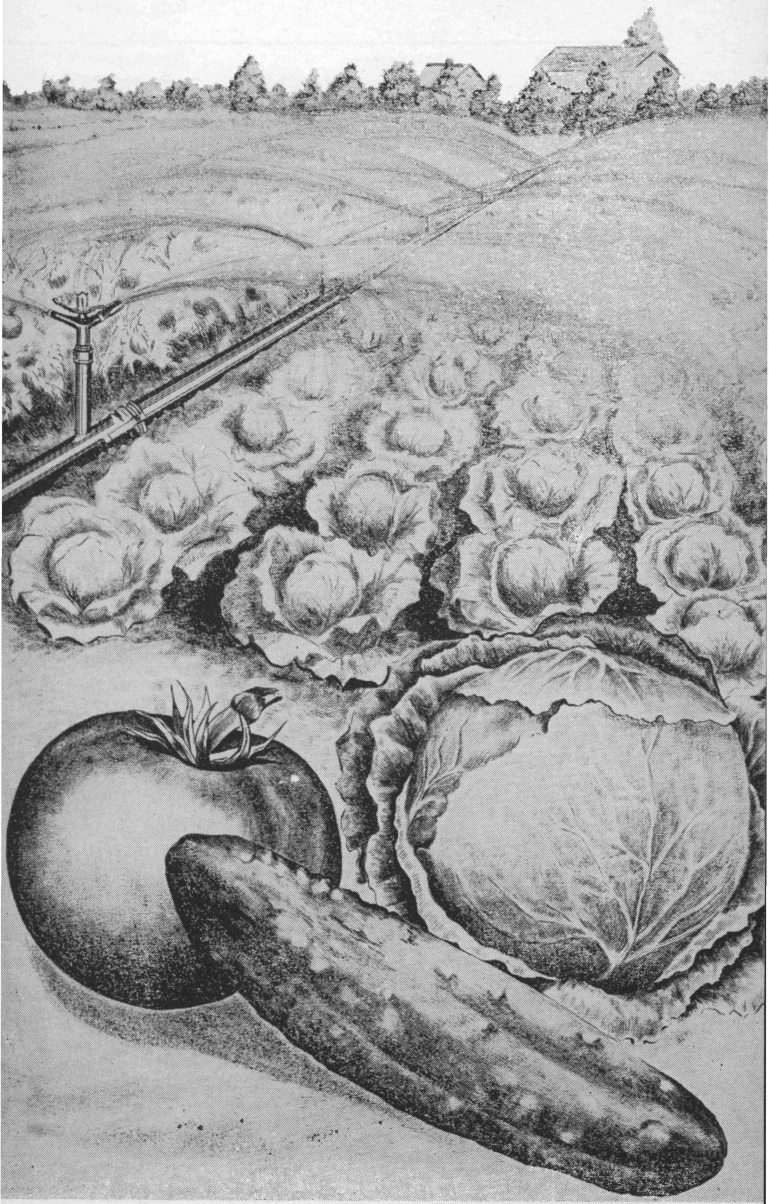
A GUIDE FOR IRRIGATING FRUITS AND VEGETABLES IN EAST TEXAS



TEXAS AGRICULTURAL EXTENSION SERVICE

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A Guide for Irrigating Fruits and Vegetables in East Texas

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Soil moisture is essential to produce high yields of good-quality fruits and vegetables. In East Texas, the average annual rainfall varies from 45 to more than 50 inches, an amount sufficient to produce large yields of quality fruits and vegetables if distributed properly. However, the distribution of rainfall in East Texas during most years is such that short dry periods often occur during the growing season causing reductions in yields and quality. Irrigation can provide a means by which East Texas fruit and vegetable growers can be assured of adequate soil moisture during the growing season.

Water Supply

An adequate supply of good-quality water is essential for irrigation farming. Possible sources are streams, rivers, ponds, reservoirs, springs and wells.

The amount of water needed during any crop season depends primarily on the type of crop grown, rainfall and climatic conditions. Generally, a minimum water supply of 5 to 10 gallons per minute per acre irrigated from wells, streams or springs is needed. If the supply is from ponds or storage reservoirs, approximately 1½ acre-feet per acre irrigated is desired.

Irrigation requires a large volume of water. One inch of water spread uniformly over 1 acre requires 27,154 gallons. A pump delivering 225 gallons per minute, operating for 2 hours, will pump the equivalent depth of 1 inch of water over 1 acre.

Methods of Applying Water

The best and most economical methods of applying irrigation water depend on individual farm conditions. The sprinkler method is adapted to all soils and crops. Land which is uniform with very little slope and is tight enough to permit uniform distribution of water by running water over the surface may be suitable for surface methods. Under such conditions, vegetables and orchards can be irrigated by distributing the water in furrows adequately spaced to meet soil and crop conditions. Flooding the land surface between small levees may be used on orchards.

The sprinkler method of water application is best adapted to most East Texas soils because they are sandy with the land surface sloping and irregular. The application rate by sprinkling should not exceed the soil intake rate. When sprinkling just before or after crop emergence, use adequate pressure to produce small droplets from the nozzle to avoid packing the soil or damaging plants.

Soil-moisture Relationships

The soil serves as a storage reservoir for water, plant food and air. Soil moisture available to plants is stored as thin films of

water around soil particles. Water applied to dry soils moves downward by gravity into the soil profile. Some of the water clings as a film to soil particles while the excess percolates downward to satisfy the needs of more particles below. A small amount of water penetrates the soil to a shallow depth. If too much water is applied, it penetrates below the plant root zone resulting in waste, or in the case where soils have poor or restricted drainage, the air space in the soil is filled completely with water, causing plants to "drown out."

The approximate water storage capacity per foot of depth for various textured soils is given below.

SOIL TEXTURE	AVAILABLE WATER-INCHES PER FOOT OF DEPTH
Sandy (coarse)	½ to 1
Sand loam (light)	1 to 1½
Silt and clay (medium)	1½ to 2
Clays (heavy)	2 to 2½

Sandy soils have less storage capacity for moisture per foot of depth than clay soils; consequently, they require more frequent and lighter applications of water.

When to Irrigate

The irrigator should be concerned with maintaining an adequate supply of available soil moisture during the growing season. Because rainfall and climatic conditions vary from year to year, exact schedules and dates for applying water are not feasible. The depth of soil penetrated by plant roots is known as the soil plant root zone. As plants use water from the soil, the available soil

moisture will become less and less until the plant has extracted all of the soil moisture within the reaches of its root system. When this condition is reached, the plant will wilt and cease to grow. The amount of available soil moisture should not be allowed to reach this condition. For most crops it is desirable to irrigate at the point when approximately **half** of the total available moisture in the soil plant root zone has been used.

A practical way to estimate the amount of available moisture in the soil is the use of the feel chart for estimating soil moisture. Take soil samples from different depths in the soil plant root zone, squeeze each sample so as to form a ball, and refer to the feel chart for a description of how various textured soils feel for various percentages of available moisture.

Applications of irrigation water based on the amount of available soil moisture in the soil plant root zone provides the best method of knowing when and how much water to apply.

Need for Drainage

Irrigated fruits and vegetables should be grown on soils which have good surface and subsurface drainage. Heavy rains following a recent irrigation may provide excessive soil moisture. For optimum plant growth, removal of this excess water is essential.

Before installing an irrigation system, make sure the fields to be irrigated have good surface and subsurface drainage.

FRUIT CROPS

CROP	ADAPTED VARIETIES	OPTIMUM PLANTING DATES	HARVEST SEASON	SEEDING RATES AND PLANT SPACING	EFFECTIVE ROOT ZONE IN DEEP SOILS (FEET)	PERIOD OF PEAK WATER USE
Blackberries	Lawton Humble	Plant root cuttings in late winter	June-July	Row spacing 8-10 ft. with plants 18-24 in. apart in rows 2,500 plants per acre	2½	From bloom until maturity of berries
Strawberries	Blakemore Tennessee Beauty	Spring planting: Feb. - Mar. Fall planting: Sept. - Nov. 1	Mar. Apr. May Feb.-Mar.	Row spacing 60 in. with plants spaced 12-18 in. apart in rows 7,000 plants per acre (matted row) Row spacing 48 in. with plants spaced 10-12 in. apart in rows 11,000 plants per acre	1	From bloom until harvest
Peaches	Early—Cardinal Dixired Second early— Coronet, Dixigem Early midseason— Triogem, Ranger Midseason— Halehaven, Loring Late— Redskin, Elberta	Winter season	June 1- August 1	Early maturing varieties: Spacing—20'x25', 87 trees per acre Midseason and late varieties: Spacing—25'x25', 69 trees per acre	3½	From time seeds begin to harden until fruit maturity
Plums	Bruce Methley (as a pollinator for Bruce)	Winter season	May 15- June 1	Spacing 20'x20' 109 trees per acre	6	From time seed begin to harden until maturity
Pecans	Stuart Success Desirable Schley Mahan	Winter season	Oct. 1- Dec. 15	8-12 trees per acre spaced 60-80 ft. apart	12-15	Kernel forming period July 15-Sept. 15

AK	PEAK WATER USE RATE (INCHES PER DAY)	MINIMUM WATER REQUIREMENTS (GPM/ACRE)*	FERTILITY REQUIREMENTS	COMMENTS
til ies	.25	4.7	N P_2O_5 K_2O 80 80 80 Applied in Feb.	Size of blackberries depends on available soil moisture. Adequate moisture during fruiting season stimulates new cane growth which influences next year's crop.
til	.25	4.7	New plantings N P_2O_5 K_2O 100 200 200 1/2 at planting and 1/2 at first bloom Old plantings N P_2O_5 K_2O 100 200 200 1/2 applied in Oct. and 1/2 at first bloom	Adequate soil moisture should be maintained during the following growth periods. Spring plantings: (1) From first bloom through harvest (Apr.-May) (2) Plant development period (June) (3) Plant maintenance period (July-Aug.-Sept.) Fall plantings: (1) Just prior to plant setting (2) From first bloom through harvest Caution: Heavy applications of water during fruiting period may cause fruit decay.
s 1 rity	.30	5.6	Bearing trees 4 lb. of 12-12-12 fertilizer formula per tree applied in Feb. 4 lb. of 5-10-10 fertilizer formula applied per tree April 1	For maximum size and fruit yields, adequate moisture is essential from time seed begins to harden until harvest. Fruit bud development for the following season's crop is dependent on adequate moisture during July and August.
1 1	.3	5.6	Bearing trees 3 lb. of 12-12-12 fertilizer formula per tree applied in February 3 lb. 5-10-10 fertilizer formula per tree applied April 1	For maximum size and fruit yields moisture is essential from time seed begin to harden until harvest. Fruit bud development for the following season's crop is dependent on adequate moisture during July and August.
			Bearing trees 7-10 lb. of 33-0-0 fertilizer formula per tree applied in Feb. or Mar.	Tests indicate that nitrogen is the only fertilizer showing responses in yield and growth. Adequate soil moisture should be maintained during the following growth periods: (1) 30 days before blooms appear (Mar.) (2) Sizing period (June through July) (3) Kernel development period (July, Aug., Sept.)

VEGETABLE CROPS

CROP	ADAPTED VARIETIES	OPTIMUM PLANTING DATES	NUMBER OF DAYS TO MATURITY	SEEDING RATES AND PLANT SPACING	EFFECTIVE ROOT ZONE IN DEEP SOILS (FEET)
Beans	Black Valentine (fresh) Tender Green (canning)	Mar. 15-Apr. 15	45-50	40 lb. per acre Row spacing 3-4 ft.	1 to 1½
Cabbage	Marion Market Early Round Dutch	Feb. 15-Mar. 15	80-90	10,000 plants per acre Row spacing 4 ft. with plants 1 ft. apart in rows	1 to 2
Cucumbers	Slicing: Marketeer Pickling: MR 17, Model	Apr. 1-15	65-70	1 lb. seed per acre Rows spaced 6 ft. apart with plants 2-3 ft. apart in rows	2 to 3
Okra	Louisiana Green Velvet	Apr. 15-May 15	60-65	5 lb. seed per acre Row spacing 5 ft. with plants 2 ft. apart in rows	3 to 3½
Onions	Green Bunching: White Pearl	Nov. 1-Dec. 15	70-75	100 lb. of sets in 42 in. rows spaced 1½ in. apart in row. 150 lb. of sets in double row on 42 in. beds, plants spaced 2 in. apart in rows	1 to 1½
	Bulbing: Excel, Granex	Feb. 1-Mar. 1	80-120	65,000 plants per acre in double row on 42 in. beds spaced 4 in. apart in rows	1 to 1½
Peas (field)	Cream 12 Extra Early Blackeye Purple Hull 49	Apr. 15-May 15	75-85	12 to 22 lb. per acre depending on seed size, spaced in 42 in. rows	2 to 3
Peppers	California Wonder Yolo Wonder Early Calwonder	Hotbed: Feb. 15-Mar. 1 Cold frame: Mar. 15-Apr. 15 Field: Apr. 15-May 1	70-80	4,500 plants per acre Row spacing 6 ft. with plants spaced 18 in. apart in row	3 to 3½
Squash	Yellow Crookneck	Mar. 15-Apr. 15	50	1 lb. seed per acre Row spacing 6 ft. with plants 3 ft. apart in row	2 to 3
Sweet Corn	Calumet 57 Ioana Aristogold Bantam Evergreen	Mar. 1-Apr. 1	75-80	8-10 lb. seed per acre Row spacing 4-5 ft. apart	3 to 4
Sweet Potatoes	Dark Skin Goldrush Red Gold Red Velvet Puerto Rico	Apr. 15-June 1	120-150	6,500 plants per acre Row spacing 52 in. with plants spaced 14-16 in. in row	2 to 3
Tomatoes	Homestead Stokes Cross No. 5 Texto 2 Rutgers	Hotbed: Feb. 1-10 Cold frame: Mar. 1-10 Field: Apr. 1-10	55-60 From field setting	4,500 plants per acre spaced in 6 ft. rows with plants 18 in. apart in row or spaced in double rows 4 ft. apart with 8 ft. middles and plants 18 in. apart in rows	3 to 3½
Turnips	Purple Top	Spring: Feb. 15-28 Fall: Aug. 1-Sept. 15	45-55	2-3 lb. seed per acre Row spacing 2½ ft. apart	1 to 1½
Watermelons	Standard types: Charleston Grey Black Diamond Icebox types: Peacock Miles	North section: Mar. 25-Apr. 15 South section: Mar. 15-Apr. 1	85-95	Standard types: 1 lb. per acre 12'x12' spacing 302 hills per acre Icebox types: 6'x8' spacing 900 hills per acre	4

*Continuous flow required per acre at 100 percent irrigation efficiency. Divide this value by estimated irrigation efficiency.

E IN LS	PERIOD OF PEAK WATER USE	PEAK WATER USE RATE (INCHES PER DAY)	MINIMUM WATER REQUIREMENTS (GPM/ACRE)*	FERTILITY REQUIREMENTS N P_2O_5 K_2O	COMMENTS
	When first blossoms appear	.20	3.7	80 80 80 Applied before planting	
	From first cupping of leaves to maturity	.25	4.7	60 120 120 Applied before planting 40 0 0 Applied as sidedressing when leaves begin to cup	For fall-set cabbage, a high soil moisture level is essential during first 3-4 weeks after transplanting and from cupping stage to head maturity.
	From half-grown stage of plant through harvest season.	.20	3.7	60 120 60 Applied before planting 40 0 0 Applied as sidedressing when vines begin to bloom	Increased yields and improved quality are obtained through maintenance of adequate soil moisture during harvest period.
	During harvest period	.30	5.6	80 80 80 Applied before planting 40 40 40 Applied as sidedressing at first bloom	Adequate soil moisture during harvest period prolongs harvest season, increases yield and improves quality.
		.18	3.4	60 120 120 Applied before planting 40 0 0 Applied as sidedressing when plants are 5-6 in. high	Adequate moisture essential from time of setting until just prior to harvest.
	30 days prior to maturity	.18	3.4	100 100 100 Applied prior to planting directly under onion row	Excessive moisture immediately prior to harvest may result in decay or lowered storing and keeping quality.
	7 days before bloom period to half-grown stage of pods	.18	3.4	30 60 60 Applied before planting	
	From first bloom through harvest period (June 15-Aug. 1)	.30	5.6	120 120 120 1/2 applied before planting 1/2 applied in 2 sidedressings as needed	High soil-moisture content should be maintained during fruiting period. If plants are allowed to wilt during fruiting, blossom shedding will result.
	After first blossoms appear	.20	3.7	60 120 60 Applied before planting 40 0 0 Applied as sidedressing when vines begin to bloom	
	10 days before tassel develops until ear is half grown	.30	5.6	40 90 90 Applied before planting 60 0 0 Applied as sidedressing at last plowing	Adequate soil moisture essential from tassel through silking period.
	From formation of small potatoes until desired size is obtained	.25	4.7	60 120 180 Applied before planting	Adequate soil moisture should be maintained from formation of potatoes until reaching marketable size. Excess moisture after desired size is obtained may cause growth cracks or development of jumbo potatoes.
	From half-grown stage of first cluster until approximately half the crop is harvested	.30	5.6	45-60 75-100 45-60 2/3 applied before planting 1/3 as sidedressing	Adequate moisture essential when plants are set in field. Uniform moisture level is essential during fruit development period. Delayed applications of irrigation water tend to increase cracking of fruit.
	From half-grown stage to harvest	.20	3.7	60 120 120 Applied before planting	Irrigation prior to seeding may be essential for uniform germination. High moisture level desired throughout entire growing season.
	From time melons are half grown in size until harvest begins	.30	5.6	45 90 45 2/3 applied before planting 1/3 as sidedressing when vines are 3 ft. long	During irrigation periods watch plants closely for appearance of anthracnose. Adequate soil moisture when melons are approximately half grown size until harvest will increase size and tonnage.

Feel Chart For Estimating Soil Moisture

Degree of Moisture	Percent of Useful Soil Moisture Remaining	Feel or appearance of soils			
		Coarse	Light	Medium	Heavy and very heavy
Dry	0	Dry, loose, single-grained, flows through fingers.	Dry, loose, flows through fingers.	Powdery, dry, sometimes slightly crusted but easily breaks down into powdery condition.	Hard, baked, cracked, sometimes has loose crumbs on surface.
Low	50 or less	Still appears to be dry; will not form a ball with pressure.*	Still appears to be dry; will not form a ball.*	Somewhat crumbly, but will hold together from pressure.	Somewhat pliable, will ball under pressure.*
Fair	50 to 75	Same as coarse texture under 50 or less.	Tends to ball under pressure but seldom will hold together.	Forms a ball, somewhat plastic; will sometimes slick slightly with pressure.	Forms a ball; will ribbon out between thumb and forefinger.
Excellent	75 to field capacity	Tends to stick together slightly, sometimes forms a very weak ball under pressure.	Forms weak ball, breaks easily, will not slick.	Forms a ball and is very pliable; slicks readily if relatively high in clay.	Easily ribbons out between fingers, has a slick feeling.
Ideal	At field capacity	Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.	Same as coarse.	Same as coarse.	Same as coarse.
Too Wet	Above field capacity	Free water appears when soil is bounced in hand.	Free water will be released with kneading.	Can squeeze out free water.	Puddles and free water forms on surface.

*Ball is formed by squeezing a handful of soil very firmly with fingers.

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