

Commercial Tomato Production *in* East Texas



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The tomato is one of the most popular of all vegetable crops. Texas leads all other states in the production of green-wrap tomatoes. The ten-year average (1936-45) acreage for the eastern Texas area was 28,600 acres with annual production of 1,972,000 bushels. Methods of tomato production in the Lower Rio Grande Valley and Winter Garden are different from those in eastern Texas and will be dealt with in another publication.

Tomatoes are one of the most important sources of Vitamin C. Due to their acid content, the Vitamin C in tomatoes is more stable than in most other foods. Tomatoes are easily canned or made into juice which makes them available the year around.

Most of the tomatoes from the eastern Texas area are harvested as "green-wraps." They are mature green tomatoes that ripen in transit and storage.

The shipping season for green-wrap tomatoes in eastern Texas begins in late May and continues in some places to mid-July. It is followed by a period of canning operations until production ceases in August. Railroad shipments amount to 5,000 to 7,000 cars of green-wraps annually. Counties leading in tomato production are:

Cherokee, Smith, Henderson, Red River, Polk, Bowie, Van Zandt, Anderson, Wood, Robertson, Shelby, Falls, and Nacogdoches.

Inferior methods of tomato production commonly result in losses or low profits. The purpose of this bulletin is to describe the best methods available, as determined by experience and research work. This information should aid farmers in increasing their profits from tomatoes in eastern Texas.

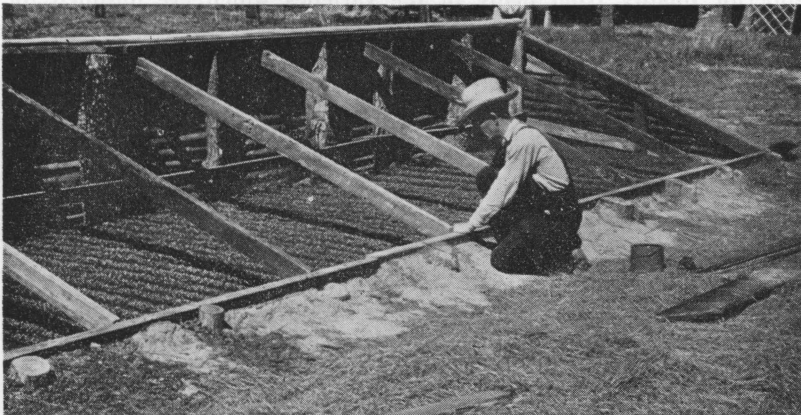
Commercial Tomato Production In East Texas

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VARIETIES

Most of the tomatoes grown in eastern Texas are for the green-wrap trade, which requires certain definite characteristics. Such well-known old varieties as Earliana, June Pink and Gulf State Market are good for the home garden, but are unsuited for shipping. Unless a variety produces early, it is of little value because the price paid for tomatoes is usually highest early in the season and decreases later.

Tests of more than 100 varieties have justified the conclusion that Pritchard, Stokesdale, Rutgers, and Marglobe are the best commercial varieties for eastern Texas. The ability of the *Rutgers* variety to color properly, its desirable shape and size, and its resistance to Fusarium wilt has made it the most popular variety; however, it is susceptible to blossom-end rot, does not set fruit under adverse conditions, and is a few days later in ripening. *Stokesdale* resists puffing and Fusarium wilt, is a prolific variety, and is about a week earlier than Rutgers. It is susceptible to sunburn because of sparse foliage. The fruit are globe shaped, but unless grown on very fertile soil, many of them are small. About 25 percent more fertilizer per acre than is used with other varieties will help increase size. *Pritchard* resists Fusarium wilt and blossom-



1. Manure-heated hotbed with canvas cover rolled back.

end rot and is comparable to Stokesdale in earliness. It is a high yielding variety with large fruits. *Marglobe* resists wilt and blossom-end rot and produces large mid-season crops of nice globular fruit. It seems best adapted in the north-eastern part of eastern Texas.

QUALITIES OF TOMATO VARIETIES

Variety	Earliness	Yielding ability	Season of usefulness	Resistance to disease		
				Blossom-end rot	Fusarium wilt	Puffing
Pritchard	Early	Highest	Spring	Good	Good	Poor
Stokesdale	Early	High	Spring	Fair	Good	Good
Marglobe	Mid-season	Good	Spring	Good	Good	Poor
Rutgers	Mid-season	Good	Spring	Poor	Good	Poor
Gulf State Market*	Mid-season	Good	Spring	Poor	Poor	Poor
Grothen Globe	Mid-season	Fair	Spring	Poor	Fair	Poor
Stone	Late	Fair	Fall	Fair	Poor	Poor
Greater Baltimore	Late	Fair	Fall	Fair	Poor	Poor
Summerset**	Adequate	Fair	Summer	Poor	Poor	Good
Porter**	Adequate	High	Summer	Poor	Poor	Fair
Danmark**	Adequate	Fair	Summer	Good	Poor	Good
Red Cloud	Adequate	High	General	Fair	Poor	Fair

* Pink purple variety for home gardens and local sale of pink fruits; poor shipping quality; canneries will not buy it.

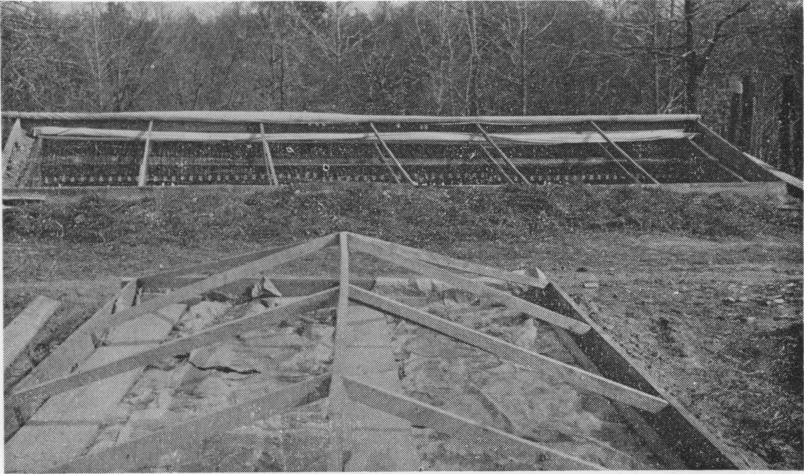
**Most fruit small (1-2 inches diameter). Use limited to summer production.

HOME GARDEN VARIETIES

The home gardener has a much larger number of varieties from which to make his choice than the commercial grower. He can expect superior quality from many of the varieties which are unsuited for market. Clinton hybrid, a new variety, has shown exceptional high yielding ability. By careful planning, he can have fresh tomatoes from the garden through the summer and up to the first killing frost. When picked before freezing, many large green tomatoes will ripen in storage.

Varieties which show promise are Red Cloud, Victor, Valiant, and Stokesdale. These varieties require a favorable growing season of only approximately sixty days. They will provide early fruit in the spring, and if new plants are started during the summer they will produce a crop during the short favorable growing season in the fall.

Since the above varieties do not produce much foliage to shade their fruit, they sunburn badly in late spring. However, by that time the green-wrap varieties with their heavier foliage will be in production. For excellent quality the Rutgers variety is hard to surpass in the mid-season group. Pritchard is also very good. Stokesdale is very prolific, and yields well until the weather becomes quite hot. (For a discussion of summer varieties, see page 18.



2. Flue-heated hotbed in background has the roll pole for the top sheet on its own separate set of rafters that are about 10 inches above the rafters for the bottom sheet. The air space between the sheets usually made it unnecessary to use the pine-needle straw that is piled in front of the hot bed. In the cold frame in the foreground, the soil had been fumigated with chloropicrin, and glue-coated paper was weighted with boards and left on the soil during the winter.

Home gardeners will usually have difficulty finding a source of plants of the varieties recommended for early spring, summer, and fall. It will probably be necessary for the gardener to produce his own plants. Summer and fall tomatoes should not be pruned.

LOCATION OF HOTBEDS

Locate hotbeds on well-drained land that is free from depressions or danger of flooding during heavy rain. A location with a southern exposure and adequate wind protection on the north and west is ideal. Plants grown in hotbeds require rather frequent watering and if possible, the beds should be located close to a water supply. In all cases, the main determining factors in locating the plant bed are protection from cold winds, direct sunlight, and convenience in tending.

MANURE-HEATED HOTBEDS

A manure-heated hotbed is built by digging a pit six feet wide, 12 to 18 inches deep and of any desired length. Line the pit with planks or green poles. The walls will extend above the ground $2\frac{1}{2}$ to 3 feet

in the back and 1 foot in front, and the cover or sash will rest directly upon them. Rafters of poles or planks 1" x 2' or 1" x 4' are tacked to the edge of the back and front walls to support the cover. Space the rafters three to four feet apart. The cover may be tacked to the back side of the bed and attached to a wooden strip or strips on which it may be rolled up and down over the rafters.

Horse manure, which has been hauled directly from the stable, should be used in hotbeds. Place the manure in flat piles beside the hotbed to remain two or three days until it begins to heat. Turn or fork it once or twice to get uniform composition and heating. In case the manure becomes a trifle dry, add a little water as it is being turned. After four or five days, spread the manure uniformly into the pit of the hotbed, taking care to eliminate all lumps and to pack the manure firmly. A little water may again be added after the manure has been placed in the pit.

The depth of the manure in the hotbed will depend on the average outside temperatures. In localities where the temperatures do not go below 12°F during the growing period, a layer of manure that is 12 to 15 inches thick will be sufficient. Spread evenly four inches of a mixture of equal parts of well-rotted cow manure and leaf mold over the heating layer of manure.

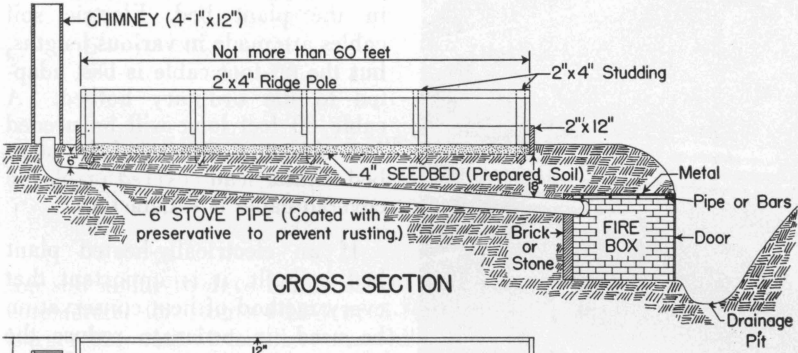
When the manure-heated hotbed is first made, it is likely to become hotter than 100°F. Delay the sowing of the seed until the temperature falls to about 85°F. This will usually be about two days after the hotbed has been built.

FLUE-HEATED BEDS

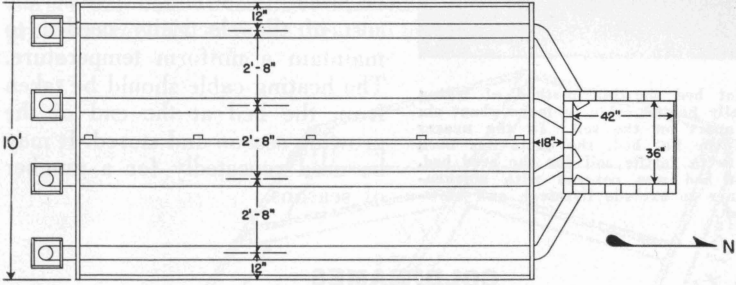
Flue-heated beds are largely replacing the manure-heated beds in eastern Texas. (Figure 2). The most common type consists of a wood-burning furnace with one or more flues upon which the soil is placed. The fuel used in these beds consists mainly of stumps, rough wood, or poles.

In building the flue-heated bed, a pit about 18 inches deep, six to eight feet wide, and 30 to 60 feet long is excavated and the sides and ends are covered with planks or green poles to prevent caving in of the soil. Frequently the pit is lined with boards nailed to stakes driven into the soil and extending 20 to 30 inches above the ground level on the back side and 10 to 12 inches on the front side. Face the bed to the south. Native rocks may be used to construct a furnace, but an old oil barrel has been the most common type of furnace used. A flue of two or more 6-inch stove pipes is placed under the bed. This is fitted with elbows which go to chimneys at the end opposite the fire box.

The stove pipes should be 18 inches deep at the fire box and six inches at the chimney. This will provide adequate draft. A cord of wood is sufficient to fire an ordinary flue-heated bed for a plant growing period.



CROSS-SECTION



PLAN

Cross-section of flue-heated bed.

Spread four to five inches of soil composed of equal parts of forest loam or rotted cow manure and rich soil inside the frame to form the seedbed. The fire is started under the bed and the soil warmed for 2 days before planting the seed.

ELECTRICALLY HEATED PLANT BED

Electrically-heated plant beds have a decided operating advantage over the ordinary manure and flue-heated beds because the amount of heat can be controlled automatically by the use of thermostats, thus avoiding extremes. (Figure 3). Electric hotbeds require very little attention as compared with hotbeds of other types. The cost of electricity is greater than for wood, but much labor is saved.



3. Hot bed showing method of laying electrically heated cable in loops about six inches apart on the soil. In the nearer part of the hot bed, the cable has been covered with fertile soil for the seed bed, and hot bed was covered with chicken-wire fence to exclude livestock and blowing trash.

When electricity is used as a source of heat, a special soil-type electric cable is obtained which is placed in the soil four to six inches below the level of root growth in the plant bed. Electric soil cables are made in various lengths, but the 60-foot cable is best adapted to the ordinary hotbed. A cable 60 feet long will be needed for each 6' x 6' area of the plant bed. Either lead covered or plastic covered cable is satisfactory.

If an electrically-heated plant bed is built, it is important that every method of heat conservation be used, in order to reduce the cost of the electricity needed to maintain a uniform temperature. The heating cable should be taken from the bed at the end of the growing season and stored. It may be used repeatedly for a number of seasons.

COLDFRAMES

Coldframes are used to produce stocky, well-rooted plants that grow with a minimum of delay when set in open fields. (Figure 4).

Coldframes protected from north and west winds usually are located close to the tomato field. A convenient source of water is important. A home water system with garden hose is best for supplying water. One of the best places for a coldframe is on the south edge of a woods, as the soil usually is almost free from parasites that damage tomatoes. Good soil drainage is important. It pays to locate the coldframe near the home for convenient care.

A frame is usually constructed to hold enough plants to set one acre. The width of rows and spacing of the plants in the rows in the field determines the size of coldframes for producing the required number of plants. The table below gives the number of plants required to set an acre at various spacings.

An 8-foot coldframe can be covered with three 36-inch strips of muslin sewed together, while a 10-foot frame requires four strips.

Thoroughly mix approximately two to four cubic yards (two wagon loads) each of well rotted cow manure and leaf mold with the

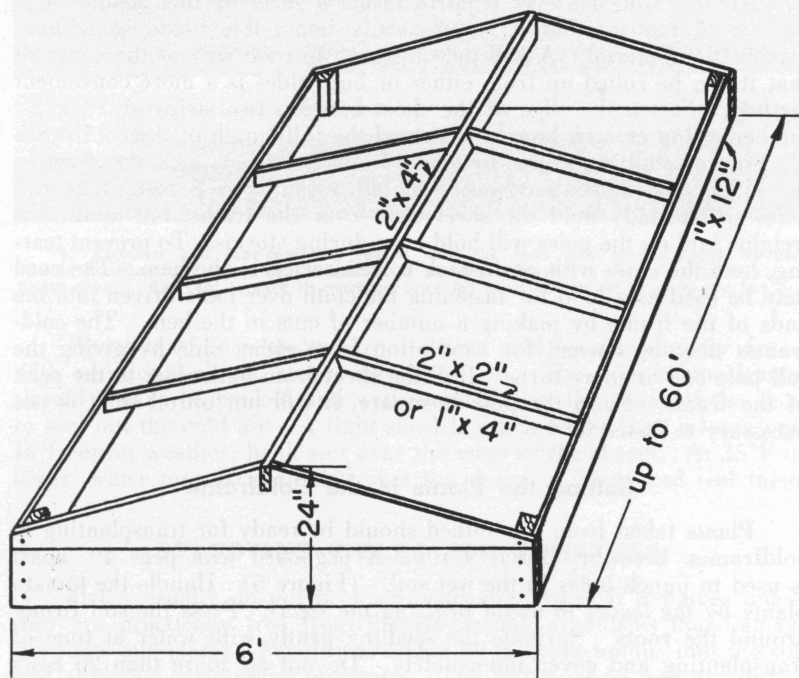
NUMBER OF PLANTS REQUIRED PER ACRE

WIDTH OF ROW	SPACE BETWEEN PLANTS	SQUARE FEET PER PLANT	NO. PLANTS PER ACRE
5'	20"	8.3	5730
5'	24"	10	4756
6'	20"	10	4756
6'	24"	12	3963
9'	20"	15	3170
9'	24"	18	2636

Size of coldframe and number of plants, 4" spacings

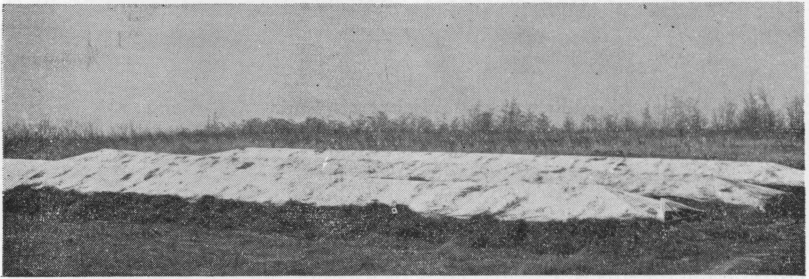
WIDTH	LENGTH	NUMBER PLANTS	YDS SHEETING REQUIRED
8'	60'	4320	62
10'	60'	5400	83

top soil about 10 days before setting. Rake about 20 to 25 pounds of a commercial fertilizer (4-12-4 or 5-10-5) into the top 3 inches of soil. Larger amounts of fertilizer may kill the seedlings, cause the plants to grow too rapidly, or make them too tender.



4. Cold frame for 1 acre—5,000 plants.

The coldframe may be built of wood, brick, or concrete, but the common practice is to make the sides of 1" x 12" lumber set on its edge on the level ground and a ridge pole three feet from the ground made of 1" x 4" lumber with 1" x 4" rafters on each side to the side boards. The muslin cover may be tacked on one side and pulled over the frame and hooked over sharp nails, but this is a slow, laborious, painful, and costly practice.



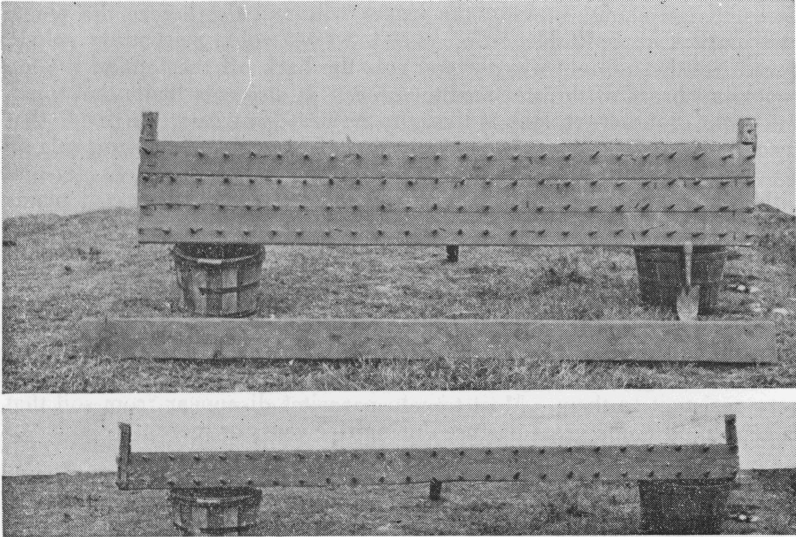
5. Tomato plants properly protected against cold weather.

Anyone who has ever tried to fasten a sheet by this method in a high wind realizes that it is practically impossible to do so without tearing the material. A roll pole fastened to each side of the cover so that it can be rolled up from either or both sides is a more convenient method. Fasten the edge of the sheet between two strips of 1" x 2" lumber, using enough boards to extend the full length of the coldframe. To prevent slipping either to one side or the other, tack the sheet to the ridge pole with short pieces of lath every 4 or 5 feet. The roll poles will usually hold the sheet tight over the frame, but additional weights laid on the poles will hold even during storms. To prevent tearing, hem the cloth with grain sack cord inserted in the hem. The cord may be used as a loop for fastening the cloth over nails driven into the ends of the frame by making a number of cuts in the hem. The coldframes may be opened for ventilation from either side by giving the roll pole one or more turns. Roll the sheet from both sides to the peak of the frame. Since the pole is square, it will not unroll so it is not necessary to fasten it.

Setting the Plants in the Coldframe

Plants taken from the hotbed should be ready for transplanting in coldframes between March 1-10th. A pegboard with pegs 4" apart is used to punch holes in the wet soil. (Figure 5) Handle the tomato plants *by the leaves to avoid bruising the stems*. Press the soil firmly around the roots. Sprinkle the seedling gently with water at time of transplanting and cover immediately. Do not set more than 20 rows of plants before sprinkling and covering. Begin setting at the windy end of the frame. Keep covered for two to four days.

Tomato seedlings cannot grow normally when they do not receive enough light. They become slender with narrow light green leaves, and their stems show very few hairs and little or no purple color. Plants of this type are very susceptible to damping off, bright sunshine and wind injury even in the coldframe. Remove sheets from hotbeds or coldframes every day from 8 a. m. to 5 p. m., if the air temperature is above 45°F. On very windy or cold days raise the edges of the sheets for ventilation.



6. Two-row and four-row peg boards with the pegs four inches apart, as used in cold framing tomatoes. In the center of picture is shown a straight board with a wedge-shaped edge that is used in marking rows for planting tomato seeds in the hot bed.

Plants may be protected from severe cold by covering the frame with additional sheets, straw, leaves, or soil. The sides of the frames should always be banked and well-rounded over the edges of the sheet to seal out the cold air. A tight sheet is much better than a loose one. In freezing weather, bank soil over the edge of the sheets. At 35°F or lower, water may be sprinkled over the sheets to freeze and seal them.

SELECTING FIELDS FOR TOMATOES

Fields usually do not produce profitable crops of tomatoes unless they are practically free from disease-causing organisms that damage the roots and stems. Fertility is added by plowing humus into the soil and applying commercial fertilizers. *The soil must be well drained.*

In eastern Texas, four main disease-causing organisms live in the

soil and often make tomato crops unprofitable. Examine the roots of preceding crops for symptoms of diseases.

Ruinous pests of tomato roots and stems are: 1) Root-knot nematodes, very small worms that can be seen clearly only when observed through a lens. They enter the roots of tomatoes and many other kinds of crops, causing small knots to appear. Numerous knots, especially on the roots of young tomato plants, prevent the plants from producing many, if any, marketable fruits. 2) A fungus, *Fusarium lycopersici*, causes browning of the wood inside of tomato tap roots and inside the bases of the stems, making the leaves wilt and die before the plants can mature a profitable crop. 3) A white mold, *Sclerotium rolfsii*, causes southern-blight disease and rots the bark off the tops of the tap roots and bases of the stems of tomatoes. It also rots fruits that touch wet soil. Southern blight is likely to be very destructive in fields that recently were in peanuts. 4) A species of bacteria, *Bacterium solanacearum*, causes brown to black discoloration of the woody tissues and pith of the base of tomato stems and the tap roots. Diseased plants often are dwarfed and the leaves may wilt suddenly.

Permanent farmers wish not only to avoid root diseases in the tomato crop, but also to kill the disease-causing organisms in the soil. This is accomplished best by crop rotation with practically immune crops, thus starving the parasites. Sorghum appears to be the best crop for controlling all of the four above parasites. Corn and rye also are very resistant to them. Most tomato parasites disappear from soil that is kept in bermuda grass pasture during five years or more.

HELPING TOMATO PLANTS TO PRODUCE HIGH YIELDS OF FRUITS

A field ready for the plants from the coldframe is prepared as follows: Plow the field early (preferably in December), mixing as much plant material as possible into the soil. Early plowing controls cut worms by starving them. About March 15, the rows six to nine feet apart are opened with a middlebuster and 400 pounds of 5-10-5 fertilizer per acre is mixed in the furrows. Two turning plow furrows are used to cover the fertilizer. Apply the fertilizer a week to ten days before transplanting time. If the soil is wet and the wind is damp, several rows may be opened at one time for transplanting tomatoes, but if the wind or soil is too dry, open only about two rows at one time as the soil dries seriously within 30 minutes. For opening tomato rows, it is customary to use a Georgia stock with a 9-inch shovel plow and a block of wood about six inches in diameter chained to the heel bolt to hold the furrow open.

Profitable yields of fruits are most likely to result when field culture begins with healthy, stocky plants six to eight inches tall. Sprinkle plants in the coldframe until the soil is very wet before taking them up. Lift 9 to 12 plants in a three-inch layer of soil with a wide

shovel or cottonseed fork. Place the plants on the smooth board of a slide or low wagon, and sprinkle until they are dripping wet. Plenty of water will help them to live through dry soil and wind in fields and to continue growing immediately. Then the plants are hauled to a field for transplanting.

Usually one person picks up two tomato plants (from the load) with a large ball of wet soil around the roots of each plant. You can carry three plants with enough soil at one time by setting the ball of soil of one plant on a wrist. Set — do not drop — the plants about 18 inches apart in the furrows. Another person usually pulls moist soil around the base of the tomato plants, setting them deeper than they grew in the cold frame. It is very important to pack the soil firmly around the ball of wet soil of every plant in an effort to connect the water in it with moist soil of the field. Hands are used to close the furrow between the tomato plants, as this makes immediate cultivation of the field unnecessary.

When a soil crust forms following a rain, an 18-inch sweep blade on a Georgia stock is used to break the soil crust and control weeds. The plow point is run about 10 inches from the rows for the first cultivation and increasingly farther away for the later ones. Sweep blades 30 to 36 inches wide are used for cultivating the middles late in May and in June. Only sweep cultivation is desirable in fields that do not become boggy. Narrow sweep blades are used to open shallow furrows for side-dressing fertilizer and to cover the fertilizer.

Because parts of many fields may become boggy and drown the tomato roots after heavy rains, most farmers use turning plows for cultivating tomatoes. Start such deep cultivation early enough to avoid cutting the tomato roots. Crop roots should never be cut because this injury decreases the movement of water and fertilizer into the plants and therefore decreases yields. Cultivating plows that turn furrows 10 to 12 inches wide are drawn about 12 inches from both sides of each row (one round) to build a 2-furrow bed and cover most of the weeds. *It should be remembered that covering the lower leaves of the tomato plants decreases the growth of the plants because the leaves make all of the food.* The 2-furrow bed is made preferably 2 to 3 weeks after transplanting the tomatoes.

Side-dressing fertilizer: About 300 pounds of 8-8-8 fertilizer per acre is mixed with the soil in the bottoms of turning plow furrows on both sides of the bed. The fertilizer is covered by completing 4-furrow beds. The job of making 4-furrow beds with the first side dressing can usually be done in one day. These beds are broad enough to avoid serious drouth injury and the ditches help to protect the roots from excess rain. About ten days later, the second side-dressing of 300 pounds of 8-8-8 fertilizer per acre is mixed in the turn plow furrow and is covered by completing 6-furrow beds. If the soil becomes packed by excessive rain, the sides of the beds can be loosened with sweep blades to give the roots air. *Warning:* Side-dressing fertilizer should

be applied only when the soil is moist or wet. Putting fertilizer near tomato roots in dry soil usually causes yellowing of leaves and shedding of flowers. Fertilizer should not come in contact with leaves or stems of the plants.

Pruning tomatoes: The purpose of pruning tomatoes is to increase the size of the earliest fruits. Branches (prunes) begin to grow from the stems at the bases of the leaves about 2 weeks after tomatoes are set in fields, which is the time for the first pruning. The branch below (or maybe above) the first flower cluster should be left to grow into the fork. Remove all ground sprouts. Prune twice, or preferably three times, early in the growing season. The leaves make all of the food for producing the fruit crop, so it pays to have as many leaves as possible on the plants. Do not top tomatoes. Leave the tops on the plants to protect the green-wrap fruits from sunburning and to produce the later cannery crop which increases profits.

Staking and tying tomatoes: Although tying tomatoes to stakes requires much labor, more than this amount of labor is saved in later operations. Dusting or spraying and picking tomatoes is much faster, easier, and better in fields of staked tomatoes. Stakes about 3 feet tall are set in the rows about 3 inches from every plant, preferably within 2 weeks after transplanting tomatoes into fields, as this is early enough to avoid injuring the roots. When the plants grow tall enough to be blown over by wind (1½ to 2 feet tall), tie them with square knots to the stakes with the flower clusters opposite the stakes. Tomato string is bought in loose coils of 100 strings and a sharp ax is good to chop off bundles of strings about 8 to 10 inches long. An additional advantage of tying tomatoes to stakes is that they hold the fruits off the soil, thereby protecting them from rot fungi that live in the soil. While many farmers have stopped staking tomatoes, it frequently would pay them to do so. Staked tomatoes are not suited to tractor cultivation.

Tractor Cultivation: Perhaps four fifths of all the tomatoes grown in eastern Texas are cultivated with horse-drawn, single furrow or one-row implements. However, many farmers are buying tractors and tractor-drawn implements, and farming of all types is being mechanized rapidly. Tractor farming of tomatoes is quite unlike team-farming.

The type of tractor a grower needs depends upon the number of cultivated acres, nature and lay of the land, and the crops to be farmed. If level cultivation is practiced with tomatoes, any type of tractor can be used with wide rows. However, this kind of cultivation is not recommended in areas of much spring rainfall, where a high bed or terrace is necessary. High clearance, 4-wheel tractors are preferred for cultivating tomatoes on beds. Either a one or two row tractor may be used, but a large heavy tractor is not necessary in producing tomatoes. The principles concerned in using a one row tractor are somewhat different from that of a two row. An important point with using any tractor is to prepare the row or rows with the same tractor that will be used in

cultivation. A two row cultivator is not likely to follow the rows prepared by a one row implement.

Since a 4-wheel tractor is best adapted to tomato culture, its method of operation will be discussed here. Turn under the crop on the land (about 7 inches deep) in the fall or early winter, leaving the surface rough to reduce erosion. Early in March, level and pulverize the surface with a disc harrow. The processes of laying-off the rows, applying fertilizer in the bottoms of furrows, and preparing the beds can be done in one operation. Open the furrow with a large sweep or small middlebuster mounted on the planter foot to which is attached the fertilizer spout and shovels. The fertilizer is covered by two sets of disc hillers mounted on the cultivator beams. A bed 12 inches high and 30 inches wide is made by this method.

Wider beds can be made by running a middlebuster between the rows. Rows spaced 8 to 10 feet apart to permit operating a tractor between the rows when the plants are nearing maturity are recommended, but 6-foot rows can be used. A row marker mounted on the front of the tractor marks the next row, keeping all rows parallel.

Setting is done much in the same order as in team cultivated fields, with the beds opened with a shovel mounted on the planter attachment to which a block of wood is attached to prevent the furrow from being filled with soil.

Cultivation is done with sweeps and disc hillers, the latter being used to raise the level of the bed. The side-dressing fertilizer is applied during cultivation, one spout being on the front cultivator foot on each side. As the plants increase in size, use larger sweeps set farther from the plants. Do not plow deeply as this destroys the feeder roots. By the time the first clusters of fruit are nearing maturity, the vines have usually become too large to straddle with a tractor. A great amount of damage is not done, however, until the flower clusters are being bruised by the tractor or implements. When this happens, limit cultivation to running through the middles only or use the horse-drawn Georgia stock to cultivate the middles. A middlebuster furrow in the middle will provide for drainage in case of excessive rainfall. One unplanted row left every 10 to 15 rows can be used for a road during harvest and will save considerable time and labor in carrying baskets of tomatoes.

A two-row tractor can be used profitably by preparing a wide bed on which two rows of plants three feet apart are set. These beds may be prepared with the use of the front gangs of a tandem disc or a one-way disc breaking plow, not less than 10 feet apart. Fertilizing, setting, and cultivation for a one-row tractor and implements is much the same as described above.

PROTECTING TOMATOES FROM DISEASES AND INSECTS

Tomato pests decrease marketable yields 20 to 90 percent per year, but losses are small in fields where good control methods are used.

Whenever the weather is rainy enough to produce good yields of tomatoes, nailhead rust, early blight, and Septoria blight commonly spoil many or most of the leaves and fruits unless the fields are dusted or sprayed properly with protective chemicals.

It is fine insurance to follow a regular schedule of dusting or spraying tomatoes to protect them from pests. Modify the schedule to fit the weather. As soon as the first tomato fruits are one-fourth inch in diameter (about May 1 near Jacksonville), dust the plants in the fields thoroughly with one of the following: White Diamond 63x dust, Stauffer 411 dust, Chipman Copper Hydro-C dust, Niagara C-O-C-S Copotex, or other dust of equal quality. These dusts contain copper to protect the tomatoes from diseases, and calcium arsenate to kill chewing insects, especially worms. A good hand dust gun is necessary for dusting tomatoes thoroughly and quickly. Dust about once a week in May at a time when there is little or no wind. Dew on the plants is not necessary because the tomato leaves, stems, and small fruits are fuzzy and sticky. Wind often stops around sunrise, sunset, and on moonlight nights. Each application requires 15 to 35 pounds of dust per acre, depending on size of plants. Continue dusting in June if nailhead rust is threatening the crop, using White Diamond 61x dust which has no arsenic in it.

Spraying with engine-power sprayer is more effective than dusting and is not limited by ordinary winds. Good sprays stick better than dusts to the leaves. The following is a good spray formula: Two pounds of Copper-A Compound (or White Diamond 61W or other chemical of equal quality) and two pounds of calcium arsenate per 50 gallons of water. It is necessary to apply 40 to 200 gallons of spray per acre for each application, depending on the size of the plants. Three-gallon sprayers are obviously unsuitable. Direct the spray sidewise onto the plant against the wind.

Economizing on pest control is as undesirable as economizing on fertilizer or cultivation of tomatoes. Large profits from tomatoes usually come only after dusting or spraying the plants *thoroughly* with the *right chemicals* at the *right time*.

Main diseases and insect pests of tomatoes: Just as successful livestock raisers learn the names, symptoms, and controls for the pests that afflict their stock, so must tomato farmers learn to recognize the common pests that attack tomatoes and to employ methods to control them.

Fruit worms, horn worms, potato beetles, blister beetles, green stink bugs, and brown cotton bugs commonly decrease the yields of unprotected tomatoes. The calcium arsenate in the scheduled tomato dust controls the worms and potato beetles. Blister beetles do not stay on tomatoes that have been dusted. Sabadilla dust (20%) or Pyrocidine (20%) dust will control the stink bugs. Usually the stink bugs are not abundant enough in fields of early tomatoes to justify the cost of dusting to control them.

Nailhead rust is caused by species of bacteria that make brown to black spots in the leaves and flower clusters and make spots in the fruit peel so that buyers cull them out of No. 1 and No. 2 grades of tomatoes. Wind-blown rain carries the bacteria from diseased spots to healthy tissues. The diseased spots appear usually in 7 to 10 days. Nailhead rust commonly spoils half or more of the fruits in many unprotected tomato fields in rainy seasons.

Early blight causes black spots one-sixteenth to one-half inch wide in the leaves. In rainy seasons, it kills one-fourth to three-fourths of the tomato leaves so that the fruits stop growing and become sunburned.

Septoria blight makes gray or tan colored spots one-sixteenth to one-fourth inch wide with brown borders in the leaves. In rainy seasons, it usually kills one-fourth or most of the leaves in unprotected fields.

Close adherence to the dusting schedule protects the tomatoes from these pests and make profitable crops possible.

HARVESTING AND MARKETING THE CROP

Green mature tomatoes are considered ready for harvest when a jelly-like substance has developed around the seeds. Most commercial varieties develop a light green color on the blossom end at the green mature stage which is a fairly reliable index for harvesting.

At the beginning of the season, picking is done once each week and as the season advances, picking every four or five days may be necessary. If tomatoes are to be sold locally as ripe fruit, pick every other day to prevent losses from over-ripening.

In picking, grasp the tomato in the hand with the thumb or forefinger pressing against the stem, and separate by a half-turn or twist. When the baskets have been filled with tomatoes, place in the shade or cover to prevent sunblister.

Tomatoes harvested at the green mature stage are firm. When handled roughly at this stage no damage is apparent. Later, in the ripening rooms or in the markets after the tomatoes have ripened, the damage done by rough handling shows up.

Most tomatoes are harvested and handled to the packing shed in bushel baskets. A one-bushel size wooden field box (15½"x 13"x 22") is considered more desirable than the bushel basket because less damage is done to the fruit. Regardless of the type of container used, careful handling is important.

PACKING SHED ACTIVITIES

The tomato grower passes his tomato troubles on to the tomato buyer at the packing shed. Here the tomatoes are weighed and the grower is paid on a per pound basis. The tomatoes are graded on a basis of US No. 1's, and US No. 2's and Culls. The tomatoes are

packed in lug-boxes $13\frac{1}{2}'' \times 16\frac{1}{8}'' \times 5\frac{3}{4}''$ which hold approximately thirty pounds net. In the packing shed, the tomatoes are packed three layers deep after being wrapped with paper over each fruit. The usual car loading system for tomato lugs is placement five rows wide and five or six rows high. Five-layer loads usually have 600 to 660 lugs per car and six-layer loads, 720 to 780 lugs per car.

Upon arrival at central market destinations, the lugs are unpacked and handled through repack establishments. Here the tomatoes are sorted out and carried through a ripening process for several days. When the tomatoes have reached the pink or red ripe stage, they are repacked and distributed to retail stores to consumers.

GROWING SUMMER TOMATOES

The choice of the proper varieties is the key to successful summer tomato production in Texas. The ability to set fruit under high temperature conditions is inherited. Most of our standard commercial varieties will not set fruit satisfactorily when the night temperatures are high. They may set a few fruits, but these usually have a greatly reduced number of seeds and tend to be "puffy."

Of course, good tomatoes may be *picked* from standard varieties well into the early summer — but these fruits are *set* under favorable night temperatures in late spring. The true summer fruiting tomatoes will *set* fruit during the hot summer months if supplied with sufficient moisture. (There are no drought-resistant varieties of tomatoes).

The Porter, Danmark, and Red Cloud varieties are superior to the standard commercial varieties in ability to set fruit under high temperatures. Red Cloud produces fruit of standard size; however, it has such sparse foliage that the fruit sunburns very badly. The Porter and Danmark are both small fruited varieties, but are not seriously affected by sunburning. All three varieties are unsatisfactory where extremely high summer temperature conditions prevail, but do well in many parts of Texas where summer temperatures are not so severe.

Summerset and Summer Prolific are two varieties developed by the Texas Agricultural Experiment Station for ability to set fruit under extremely high temperatures. They have been known to possess this characteristic to a marked degree under the most severe summer temperatures encountered in Texas. At these high temperatures the fruit is seedless, but rarely puffy, and is of good quality, although small. (When grown at moderate temperatures, both varieties produce seed normally). Summer Prolific is larger fruited and more productive than Summerset in some areas. It is described in Progress Report 1105 of the Texas Agricultural Experiment Station. Summerset is described in Progress Report 732.

Summer tomato production has been largely confined to home gardens. If a large fruited variety with the ability to set fruit under high temperatures can be developed, there is reason to believe that it

may be of limited commercial value in irrigated regions of the state.

Cultural practices can be followed with summer fruiting tomatoes grown in the home garden which would not be economically sound for commercial crops. A heavy application of *well-rotted* manure worked into the soil thoroughly should increase production. (Do not use fresh manure, as it is harmful to the plants.) Mulching with a six inch layer of straw or hay around the base of the plants is a good practice. Avoid frequent watering. Instead, *soak* the soil thoroughly and cultivate, then wait until it becomes dry before watering again. This program should give you good yields of tomatoes through the hottest part of the summer.

COMMERCIAL FALL TOMATOES IN EAST TEXAS

Tomatoes that produce good yields in October to December pay well. Some farmers choose freshly cleared land because it has much organic matter in the soil and does not form a hard crust after rains. Rutgers appears to be the best variety for fall tomatoes due to its fine flavor and wilt resistance. However, many farmers plant the Greater Baltimore and Stone varieties which are later in bearing habit and very susceptible to Fusarium wilt. If the soil does not form a crust after rains, the seeds may be planted directly in hills about four feet apart in rows of six feet apart in fields, about May 15 to June 1. If the land forms the usual crust after rains, it will be necessary to place a handful of well-rotted cow manure or rich woods soil over every hill where tomato seed is planted to prevent a soil crust through which few tomato seedlings could emerge. After the seedlings are growing well and a few inches tall, they should be thinned to one or possibly two plants per hill. Fall tomatoes are not pruned.

A more certain method of getting a good stand of plants on most farms is to plant the tomato seeds at the rate of about 30 seeds per foot in rows 12 inches apart in a hotbed about May 20. When the plants are six inches tall, transplant them about four feet apart in rows six feet apart in a field, and water abundantly if the soil is not wet already. A starter solution also would help the slip plants grow faster. If the weather is dry, water the plants two or more times so that they can develop good root systems with which to endure later drouth. If the plants are taller than 10 inches at transplanting time, lay the lower parts of the stems down in the holes in the soil and cover so that only about four inches of top is in the air. Fall tomatoes set very few fruits until cool weather, about September 20.

Fruit worms may destroy half of the fall crop tomatoes and stink bugs and leaf-footed plant bugs may spoil most of the fruits and wilt the tops of the plants unless the plants are protected. White Diamond 63X dust controls the worms and 20% Sabadilla or Pyrocidine dust will prevent serious damage from the sucking bugs. It is very important to start pest control soon enough with the right chemicals, and dust the plants thoroughly, often enough. Fall tomatoes sell for high prices.

MARKETING PINK TOMATOES

In fruit markets, "pink" tomatoes refer to unripe fruits, while in seed catalogues, pink or pink-purple colors describe varieties like Gulf State Market in contrast to the red or scarlet-red varieties like Rutgers. For marketing "pink" tomatoes, pick the fruits three or four times per week when they show a little pink color near the blossom ends. Such fruits will ripen into bright red fruits within two to four days with fine flavor and appearance. Hence, farmers in some states market green tomatoes with pink blossom ends to please the people who eat the fruits. These fruits may be packed with or without wrapping in 4-basket crates, or they may be wrapped and packed in three pound lugs like green-wrap tomatoes. These rapidly ripening pink-marked fruits are shipped by express, by truck, or in refrigerated cars by fast freight. However, such fruits are quite perishable so marketing agencies prefer green-wrap tomatoes that can be stored during a week or two in the marketing process. When green-wrap tomatoes are picked only one to three days before they begin to turn pink, they make fine red fruits. In contrast, when green-wrap fruits are picked a week or two before they are mature enough to ripen, they finally turn yellowish-red or orange color, sometimes become wrinkled, and usually have an inferior flavor. Such fruits often are served as slices with some green color in them and do not give customers much pleasure. For finest flavor, tomatoes should be sun-ripened on the plants and eaten as soon as they become soft and red; however, soft red fruits are too perishable for most markets.

SELLING TOMATOES TO CANNERIES AFTER GREEN-DEAL

The sale of ripe tomatoes to canneries may increase the profit from the crop. Because the No. 1 green tomatoes are usually too expensive for canneries to buy, they wait until the latter part of the green-deal shipping season at which time prices are lower. Then, many farmers haul their cull fruits home from the green-deal sheds and ripen them for the canneries. In ripening tomatoes for the cannery, spread the green fruit out in layers *only 1-fruit deep* on the floors of old buildings or in the shade of trees. It pays to discard decaying fruits nearly every day to prevent the parasites in them from decaying adjacent fruits also. All of the tomatoes of marketable size are picked from fields once or twice a week in July and August. The green and pink fruits are spread out in the shade to ripen while the red fruits are added to red fruits that have ripened in the shade for hauling to the canneries. Tomato fields commonly produce fruits that sell to canneries for \$25 or more per acre after the green-deal sheds close.