FARMERS' BULLETIN 1233
UNITED STATES DEPARTMENT OF AGRICULTURE

TOMATOES *for* CANNING *and* MANUFACTURING

THE TOMATO is third in value of the vegetable crops. A large portion of the crop is canned or made into soups, purees, etc.

In the United States from 200,000 to 300,000 acres are devoted to the crop annually for canning and manufacturing purposes. The yield is about 1,000,000 tons per annum.

The industry is widely scattered over the United States, but Maryland, New Jersey, Virginia, Indiana, and California produce a large part of the crop.

The practice of a farming system that will keep the soil well supplied with available plant food is essential to success.

Good soil, good seed, strong well-grown plants, careful setting, and good cultivation are essential to good yields and satisfactory returns.

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TOMATOES FOR CANNING AND MANUFACTURING

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CONTENTS.

IMPORTANCE OF THE CROP.

The tomato is one of the few vegetables of American origin that have attained great commercial importance. Introduced into the United States about 1800, it was for a long time looked upon largely as an ornamental plant. Owing to its relation to the nightshade family, it was regarded with suspicion and was said to be poisonous, and it was not until after this strong prejudice had been broken down that its cultivation began to attract attention and its use became general.

About the middle of the last century canned tomatoes were introduced as an article of trade, and the tomato-canning industry soon attained considerable importance. In 1887 the total pack of canned tomatoes in the United States was about 3,000,000 cases, each case containing two dozen No. 3 cans, each holding approximately 1 quart.

Tomato production has grown until at the present time (1921) the tomato occupies third place among the vegetable crops in value, being exceeded only by potatoes and sweet potatoes. The average annual pack of canned tomatoes for the 10 years ended with the season of 1920 was approximately 12,794,610 cases of No. 3 cans or their equivalent. In addition to the tomatoes canned, large quantities were used for the making of soups, purees, and pulp.

The total acreage and yield for the United States for the years 1918, 1919, and 1920 for canning and manufacturing purposes was approximately as shown in Table I.

TABLE I.—*Approximate acreage and yield of tomatoes used for canning and manufacturing purposes in the United States in 1918, 1919, and 1920.*

Items of comparison.	1918	1919	1920
Area grown.....acres..	317,102	195,645	244,745
Yield.....tons..	1,323,059	724,912	1,003,358
Canned product.....cases (each containing 24 No. 3 cans)..	15,882,372	10,809,660	11,368,000

The popularity of the tomato, as well as of the canned products made from it, is due to its pleasing acid taste, which is retained to a very large extent in the manufactured goods, and to its cheapness. Tomatoes, especially those canned whole, are very similar to the raw product, as the treatment in canning does not materially change the character of the vegetable.

DISTRIBUTION OF THE TOMATO-CANNING INDUSTRY.

The tomato is a crop requiring a moderately warm climate and a long growing season for its best development. In the Northern States where the frost-free season is too short for maturing the crop out of doors it can be grown by starting the plants indoors, thus prolonging the growing season by several weeks. By following this practice, it is possible to grow tomatoes in a commercial way in regions where the industry could not otherwise flourish. In climates where its growth is not interrupted by frost, the tomato is a perennial plant, but in the portions of the United States where the tomato-canning industry has attained its greatest importance, the tomato is treated as an annual.

Climatic conditions, nearness to market, labor supply, soils, and other factors have all had an influence in the development of the industry in Maryland, California, Indiana, Missouri, Delaware, New Jersey, New York, Utah, Illinois, Kentucky, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia, where the major portion of the tomatoes grown for canning and manufacturing are produced, the volume of the pack in the several States being in the order mentioned.

The geographical distribution of the industry is indicated in figure 1, each dot on the map indicating a factory devoted to the canning or the manufacture of tomatoes into soups, etc. While many of these factories may be operating under serious economic disadvantages, the map shows that tomatoes for canning and manufacturing are being grown and packed over a considerable portion of the United States.

While the high temperatures and hot sun of the lower South are not well suited to the growing of tomatoes for canning and the northern limit of their growth is established by the short growing season of the northern portion of the United States, it does not follow that the present distribution of the industry is in all cases economically sound. Within the climatic range to which the tomato is adapted it is not particularly exacting as to soil requirements. Any good soil suitable for general farm crops can readily be adapted to the growing of tomatoes for canning. The plant requires from 80 to 110 days from seed to come into bearing, but about one-third this period can be spent in the greenhouse, the hotbed, or some other protected place, and the growing season can in this way be considerably lengthened.

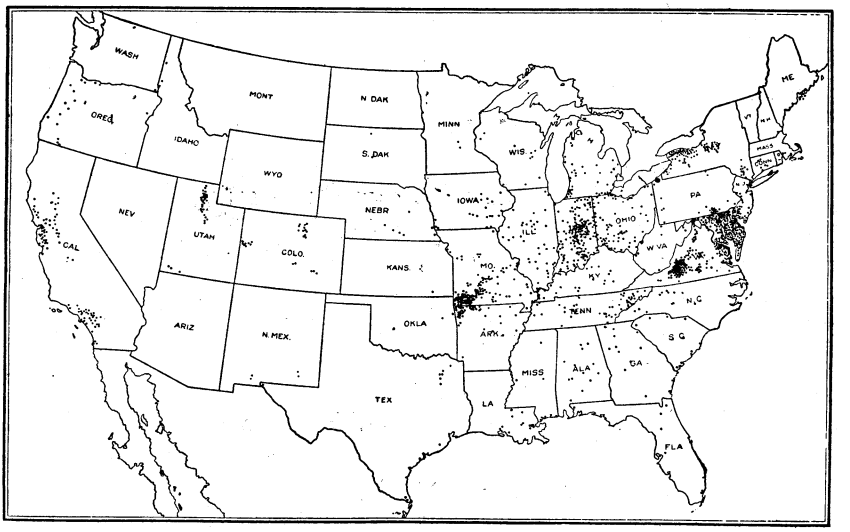

FIG. 1.—Map of the United States, showing the distribution of the tomato-canning industry. Each dot represents one canning, soup, puree, or other tomato-product factory.

The plant bears until killed by frost unless injured by drought, insects, or diseases; hence, the longer the producing season the higher the yields. During the producing period the plant does best when the day temperature is from 80° to 90° F. and the night temperature about 60°. The crop requires about the same amount of moisture as other farm crops grown in the sections to which tomatoes are adapted. From a consideration of these factors, it is apparent that large areas, lying in a broad belt between the extremely hot lower South and the short growing season areas of the North are, as far as the general requirements of the plant are concerned, well adapted to the growing of tomatoes for manufacturing purposes. The very fact that the tomato can be so easily produced under a wide variety of conditions has in the past led to the development of the industry in sections where

there have been and are few economic reasons for its continuance. In sections where the soil is very light, requiring large quantities of organic material and commercial fertilizers and where the crop is easily injured by drought, and where, as a rule, under such conditions the yields are low, growers are at a serious disadvantage. When the crop is grown for canning only and where nearness to market is not essential, it would be better to center the industry in sections where these unfavorable conditions do not exist, provided the other essential factors are present. The tendency at the present time is toward either the moderate-sized factory located near the source of supply of tomatoes or to the small farm cannery handling the product of one or two farms and often making some special product.

METHODS FOLLOWED BY CANNERS TO OBTAIN A SUPPLY OF TOMATOES.

Canners secure their supply of tomatoes either by contracting with growers for a definite acreage, by growing them themselves, or by buying them in the open market.

It is difficult, however, for the canners to safeguard a sufficient supply without some form of contract with growers. In some cases, a plan has been devised whereby the growers are guaranteed a fixed minimum price for their tomatoes, this price being sufficient to return them the cost of growing the crop, and the final settlement is made on the basis of the price received for the canned goods. Some such plan as this may obviate many of the difficulties experienced in the past. Canners and growers should realize that their interests are in common and that each is indispensable to the other. The canner must have tomatoes if he is to operate his factory, and he in turn gives the grower a ready market for his crop.

Some of the large canning companies now produce a large percentage of the tomatoes they require on land either owned or leased by them. Such companies maintain a farm department, with the necessary equipment to plant, care for, and handle the crop. This plan has many points in its favor, but is hardly practicable for any but the small canner handling the product of his own farm or for the very large concern able to command sufficient resources to produce the crop along the most advanced lines. Where a sufficient supply can be obtained from the farmers, most firms prefer to devote their whole energies to the manufacturing end, leaving the growing of the crop to the farmers.

In parts of the Tri-State territory, consisting of Maryland, Delaware, and New Jersey, where in the past more than half of the tomatoes grown for canning have been produced, some growers sell the early crop on the market when prices are high and dispose of the

later portion to canners or soup manufacturers. In this way a higher average price is received for the crop, and the plan often works to the advantage of both growers and canners. Few canners depend on buying their entire supply on the open market, preferring as a rule to contract for at least 90 per cent of their requirements. Some large manufacturing firms follow the practice of buying the surplus stocks of tomatoes on certain markets available to them when the price drops to a specified point. Part of the surplus is thus taken off the market, and this acts as a safety valve, the growers being guaranteed against the entire loss of this part of their crop.

Whether the farmers have a direct financial interest in the cannery end of the business or not, there should be sufficiently close relations between the farmers and the canners to permit the employment of every agency to increase the yields and make the industry a profitable one to both, for unless the business gives the growers and canners reasonable returns, they can not be expected to continue the production and the packing of this crop.

Within the past few years the growing and canning of tomatoes have not been uniformly profitable to growers and canners. The average yield for the past few years in the Tri-State territory has been less than 4 tons per acre and in Indiana less than 5 tons per acre. Some growers in these States have uniformly obtained much higher yields, 10 to 12 tons per acre being quite common. Growers who expect to make a success of tomato growing must obtain good yields, and the purpose of this bulletin is to point out some of the practices which have proved successful in increasing the yields of tomatoes.

CROP ROTATION.

A crop rotation that will keep the soil in good physical condition and well supplied with organic matter is particularly desirable on farms where tomatoes are grown year after year. The rotation should not include such crops as potatoes, peppers, or eggplants, as these are related to the tomato and liable to spread the diseases affecting the tomato. A rotation that includes at least one crop or combination crop of clover or cowpeas is extremely desirable. It is too often the practice to relegate the tomato crop to the poorest part of the farm, using the good ground for other crops. The crop should be placed on good ground if success is to be expected. For details as to the rotation best suited to local conditions, the county agent should be consulted.

It is often possible to add materially to the organic matter in the soil by growing cover crops between the rows of tomatoes, sowing these crops after the last cultivation of the tomatoes. When it is the plan to use such crops, the tomatoes are usually set in rows 5 or 6

feet apart and 3 feet apart in the rows, this method of planting giving practically the same number of plants per acre as when set at standard planting distances, as practiced in the past. Where it is possible to get a stand of crimson clover, this is an ideal crop for this use. Cowpeas and soy beans are also extensively used for this purpose.

The particular method to be followed must be determined by the conditions found on each farm, but the purpose should be to keep the ground occupied at all times with some crop that is adding vegetable matter to the soil, preferably one that is adding plant food in the form of nitrogen. It should be remembered that even the non-nitrogen-gathering green-manure crops add to the fertility of the soil by making available much of the insoluble plant food found in most soils.

SOILS FOR TOMATOES.

Tomatoes can be grown on a wide range of soil types. They are successfully produced in commercial quantities upon soils varying from mucks to clays and from clays to comparatively light sands. Light soils, however, are open to the objection that they suffer severely from drought and are hard to keep supplied with organic matter and available plant food. On the other hand, such soils are easier to work, are usually earlier, and the cost of preparing the ground and planting and caring for the crop is less than for heavier soils. It is believed by many authorities that tomatoes grown on light soils are of a better quality than those grown on heavier soils.

The tomato is very sensitive to poorly drained soil, and such ground should never be used for the growing of this crop. The land should be in a high state of fertility and in good physical condition as a result of proper treatment during previous seasons and should not have been in tomatoes, potatoes, peppers, or eggplants for at least three years. Crops which are closely related to the tomato may serve as host plants for various diseases which may later attack the tomato crop.

PREPARATION OF THE SOIL.

Where fall plowing can be done without sacrificing well-established cover crops, it is in many cases desirable. On heavy soils, where it is possible to practice it without injury to the soil through leaching and washing, fall plowing is a good custom, as it promotes more thorough decay of roots and other organic matter in the soil and, owing to the alternate freezing and thawing, puts the soil in better physical condition. Plow as deeply as the soil will permit, and gradually increase the depth of plowing by half an inch each season until the soil is at least 8 inches deep. It is not desirable to increase

the depth of plowing suddenly so that large quantities of subsoil are brought to the surface, but through gradually deepening the plowing the soil can be increased in depth without affecting the present crop. The final result will greatly improve conditions for the growing of tomatoes and other crops. In case a cover crop or sod is to be plowed under, disking is recommended before plowing, as this will hasten the decay of the material being turned under. The preparation of the land after plowing should be more thorough than is ordinarily given for general farm crops. Before setting the plants and topsoil should be well pulverized to a depth of 3 or 4 inches.

MANURE.

Many growers prefer to apply stable manure to the crop preceding tomatoes rather than to the tomato crop itself. Unless the soil is exceedingly rich in available plant food, however, there is no objection to the application of moderate quantities of well-rotted stable manure directly to the tomato crop. If long, strawy manure is used, it should be plowed under. If the manure is short, it may be applied broadcast as a top-dressing and worked into the soil before planting. The application of 10 to 12 tons per acre is desirable, but owing to the increasing scarcity of stable manure growers of canning tomatoes as a rule can not depend upon this material for the maintenance of their soil. They should, through proper farm practices, keep the soil well supplied with organic matter obtained by growing and turning under such crops as crimson clover, cowpeas, soy beans, rye, vetch, and winter oats.

LIME.

Where lime is needed to correct soil acidity, it should by all means be used before attempting to grow a crop of tomatoes. There is no safe rule for the application of lime to tomato land, but, generally speaking, the lighter soils used for the growing of tomatoes have a sufficient supply of lime. Heavier soils are more likely to need lime, but in all cases an actual test is necessary. Applications of 1,000 to 2,000 pounds per acre of ground limestone will usually be sufficient, as moderate applications at frequent intervals have been found to be more desirable than heavy applications at less frequent intervals. Where quick results are desired, a small quantity of ground stone lime or hydrated ground lime may be used.

COMMERCIAL FERTILIZERS.

The judicious use of commercial fertilizers will, in most cases, pay good returns; but, as pointed out in previous paragraphs, it is far better to use soil that is in good physical condition and well sup-

plied with plant food through years of proper treatment than it is to depend upon heavy applications of commercial fertilizer to improve the crop.

However, in the older tomato-growing sections the best growers use considerable quantities of commercial fertilizer directly on the tomato crop, and it pays them good returns. A few years ago it was the practice to apply fertilizers containing 4 per cent nitrogen, 8 per cent phosphoric acid, and 10 per cent potash; but during the past few years, owing to the scarcity of potash, this has been cut down until at the present time mixtures containing 4 per cent nitrogen, 8 per cent phosphoric acid, and 4 per cent potash are about as high in potash as can be obtained at reasonable cost. A mixture with 2 per cent nitrogen, 8 per cent phosphoric acid, and 3 per cent potash gives good results, and on most soils this can be used profitably at the rate of about 1,000 pounds per acre. When used at this rate, 600 pounds should be broadcasted before the field is laid off and 400 pounds should be applied in the rows about 10 days before setting the plants.

Under certain conditions it is advisable to use an additional side dressing of nitrate of soda or sulphate of ammonia, and when this is done it is usually applied from four to six weeks after setting the plants, at the rate of 100 to 150 pounds to the acre. In using nitrate of soda or sulphate of ammonia the fertilizer should be applied a few inches from the plants, care being taken that none of it falls on the foliage.

As a rule, the lighter soils demand heavier applications of fertilizer than the heavier ones.

When moderate applications of manure are made, 400 pounds of a fertilizer with 4 per cent nitrogen, 8 per cent phosphoric acid, and 4 per cent potash per acre in rows under the plants will be sufficient.

VARIETIES AND SEED.

Poor yields of tomatoes are often due to the use of poor seed and unsuitable varieties, and in some cases to the use of mixed seed. Next to poor soils the greatest menace to the industry is poor seed, especially the promiscuous cannery-run seed which is saved from catsup and tomato pulp manufacture. Cannery-run seed is often a mixture of varieties, frequently carries disease affecting the fruits as well as the young plants, and is never saved from selected stock. Its use can not be too severely condemned. Two ounces of good seed will produce an abundance of plants to set an acre. Even though good seed may be expensive, its use is advisable.

Satisfactory tomato seed suited to the growers' conditions can be purchased from dealers who have made a specialty of its production.

It is also possible to secure excellent results by individual growers or associations of growers saving their own seed. If the individual grower desires to work alone, he can select a few plants of the type he desires and save his seed from these plants. If it is advisable for an association of growers to unite their efforts and save enough seed for the use of the entire membership of the association, this work can readily be done by one or two growers who have satisfactory facilities for producing the seed. The selection of seed from a high-yielding field will help, but such selection will never develop a very high strain, since the plant itself is the unit that must be considered.

Where fields are set aside for seed purposes, individual plants of the desired type should be marked and the product of these plants taken for seed from which to grow the plants for next year's crop. Tomatoes from the undesirable plants in the field should be gathered separately and used in such a way that none of the seed from them becomes mixed with that of the selected plants. There is little to be gained from the saving of seed from fine, large tomatoes irrespective of the plant from which they have been taken. Provided the proper type is selected, the seed from the small tomatoes borne on selected plants is just as desirable as that from the larger tomatoes. Through the home or community selection of seed good strains can soon be developed.

Considerable progress has been made within the past few years in the development of strains of tomatoes resistant to wilt. Among these may be mentioned the Wilt-Resistant Stone, Wilt-Resistant Greater Baltimore, Norton (a wilt-resistant Stone), Arlington (a wilt-resistant Greater Baltimore), and Marvel (an early wilt-resistant variety). For early tomatoes the Bonny Best, John Baer, Chalk's Jewel, and Delaware Beauty are satisfactory varieties. For late tomatoes the Greater Baltimore, Stone, Paragon, Success, Matchless, and Red Rock are satisfactory.

GROWING THE PLANTS.

Strong well-developed plants are essential to the production of profitable crops of tomatoes. The method to be followed in obtaining these plants must be determined, to a large degree, by the geographical location of the grower, by the equipment available, by the time in the season the plants are needed and by the desired size of the plants themselves. As already pointed out, the growing season can be lengthened several weeks by growing the plants indoors, as it is possible with proper facilities to have them well advanced when set in the field. In some sections the canners grow the plants, charging their growers the cost of the plants. In other cases, several

farmers unite to grow enough plants for the needs of all, dividing the cost among them. Perhaps the most general practice is for the individual tomato growers to start their own plants, making use of whatever facilities they may have. Whatever the method followed in obtaining the plants, the aim should be to secure plants that are free from disease and that can be moved from the plant bed to the field with a minimum amount of shock. It is obvious that the grower who is so situated that it is possible for him to grow his plants can, with proper precautions, produce stronger and healthier ones than would be possible with plants grown at a distance. Such plants can be moved from the plant bed to the field without much shock to them, which is sure to result when they are shipped long distances.

THE SEED-BED METHOD.

The method of growing tomato plants in the open on a specially fitted piece of land is very largely followed in Delaware, Maryland, New Jersey, Virginia, and other sections where canning tomatoes or plants for sale to canners are grown. The common practice of using the same area year after year for the seed bed is open to the objection that such ground is liable to become infected with diseases, such as collar rot. When it is necessary to use an old seed bed, it should be sterilized with steam, hot water, or formalin. Such a practice is an effective insurance against certain diseases and is well worth the necessary effort. Directions for sterilizing seed beds may be found in Farmers' Bulletin 996, United States Department of Agriculture.

Unless it is possible to sterilize the seed bed thoroughly each year, it is better practice to select a fresh area for the plant bed. A desirable and common practice is to burn large quantities of brush on the area, thus destroying many weed seeds and adding considerable quantities of potash to the soil.

The seed bed is, as a rule, prepared in the early spring, and as soon as the ground is warm the seed is sowed in drills from 2 to 4 inches apart with from three to five seeds to the inch. It is the aim to cover the seed about half an inch deep, provided the soil is of a light texture, and not more than a quarter of an inch deep if the soil is of a heavy or clayey nature. It is an excellent plan to mark the ground off with some suitable marking device, place the seed in position in the drills, and cover it with a screened mixture of half leaf mold and half sand. After the plants are well up, they should be thinned, so they will stand about half an inch apart in the rows. Many growers do not practice this thinning, on account of the labor involved, but it is extremely desirable.

This method of growing tomato plants, while very largely followed, is open to several very serious objections. In the first place, the

plants can not be produced sufficiently early in the season for the best results. Again, plants grown in seed beds without transplanting are never as strong and healthy as transplanted plants. While the method gives great numbers of plants at low cost, it should not as a rule be followed. One of the greatest handicaps to the tomato industry to-day is the use of poor plants, and the seed-bed method of growing plants as a rule does not give good plants. It is far better to employ a method that will give better plants, even though the cost of these plants be higher.

THE HOTBED-COLDFRAME METHOD.

A method frequently followed, and one which usually gives good results, is to sow the tomato seed in hotbeds heated either by manure, coils of steam, hot-water pipes, or a flue some six weeks before the time to set the plants in the field. The seed is sown in drills, as in the case of the outdoor seed bed, although it may be sown more thickly in the row than would be permissible were the plants to grow in this position until taken to the field. About 10 days to two weeks after sowing the seed the plants should be ready for transplanting to coldframes fitted with sash or muslin covers, to protect them from occasional frosts. These coldframes have from 3 to 4 inches of thoroughly fine and well-rotted potting soil, in which the plants are set, spacing them about 3 inches apart each way. They are allowed to grow in this position until time to move them to the field. During their growth in the coldframe the sash or cover is gradually removed, keeping the temperature as low as practicable consistent with safety to the plants. This practice tends to give strong, stocky plants that will not suffer much shock when shifted to the field. During the later stage of growth the covers are removed entirely. (Fig. 2.)

When the time comes to set them in the field, the root system of the plants will have spread through most of the top layers of soil, and the usual practice is to cut the plants apart with a spade or trowel, allowing each plant to retain its square of soil with as little disturbance of the root system as possible. The plants are set in shallow boxes, or flats, and transported to the field, and when set in position with care need suffer little disturbance.

A modification of this method is to transplant plants to flats, or shallow boxes, instead of to the coldframe direct, setting these flats in the coldframe, so that when planting time comes these boxes can be moved to the field and the plants cut apart and set directly into the open ground. When such boxes are available, this plan is an excellent one to follow and with proper care gives strong, healthy plants. (Fig. 3.)

GREENHOUSE-GROWN PLANTS.

Another method that gives good results is to sow the seed in flats in the greenhouse, covering it with leaf mold and sand. (Fig. 4.)

When the plants are ready for transplanting they are shifted to paper bands or pots (fig. 5), these being set in flats or directly on the greenhouse benches and kept under suitable temperature and moisture conditions. At the end of about two weeks they are again transplanted to larger bands or to pots and then shifted to an outdoor coldframe and handled as in the case of plants grown according to the second method described.

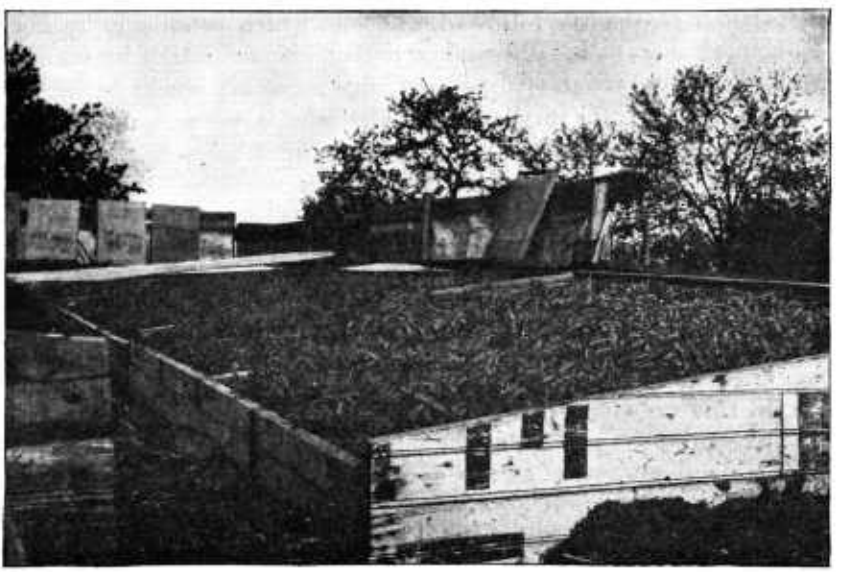

FIG. 2.—Coldframe occupied by a crop of strong, well-hardened tomato plants. The covers are held in readiness for a sudden cold night.

Transplanted plants always have better root systems and are stronger and more stocky than those not transplanted, two transplantings giving correspondingly better results than one. Where the cost of labor is not too high it will pay to grow transplanted plants, as the results from the use of such plants are usually better. Plants of the type shown in figure 6 can be produced by following the method just described.

Whatever the method followed in producing the plants, too much attention can not be paid to the control of conditions under which the plants are grown, as this almost wholly determines the success or failure of the effort. The soil used for the seed beds should always be sterilized. The flats should be filled with thoroughly prepared potting soil made up of 1 part well-rotted manure and 2 parts well-

rotted sod. This material should be prepared the season before by composting sod and manure. Some two or three weeks before it is time to sow the seed this compost should be placed either in the hotbed or brought into the greenhouse, so that it will reach a temperature of 60° to 70° F. before the time to sow the seed. If the seed is to be sown in the hotbed, the soil may be placed in sacks or boxes, put in steam boxes, as described in Farmers' Bulletin 996, and thoroughly sterilized. It will be necessary to allow the soil to dry out before placing it in the hotbed ready for the seed. When the seed is to be sown in the hotbed, however, it is best to sterilize it in position by the methods described in the Farmers' Bulletin mentioned. A steam cabinet should be used when the seed is to be sown in flats

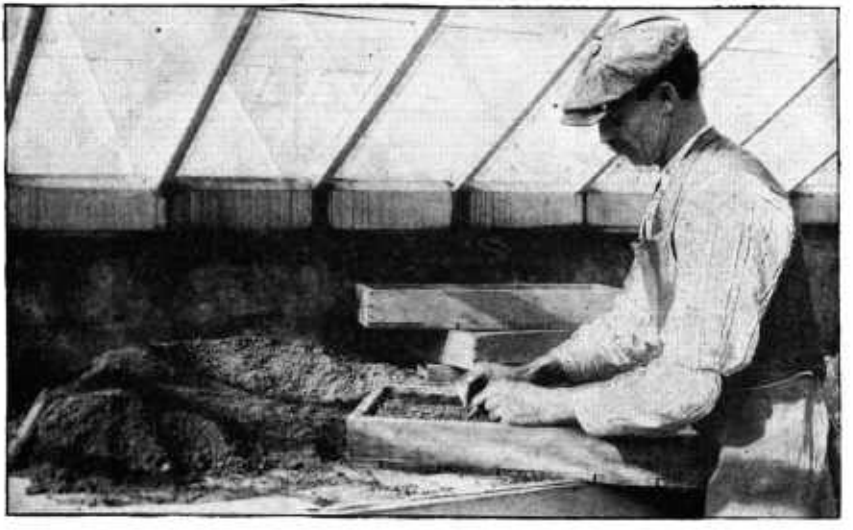

FIG. 3.—Transplanting tomato seedlings to flats, where they are allowed to grow until it is time to set them in the field.

in the greenhouse. Such a cabinet is inexpensive and can be made of lumber, concrete, or brick. The one shown in figure 7 is constructed of concrete and is so planned that the flats filled with soil can be stacked on a truck and rolled into the cabinet. It is suggested that sterilization equipment be constructed at the cannery, where steam is available.

Tomato seed germinates best at a temperature of about 70° F., and care should be taken that the soil is not kept too wet, as moisture is likely to induce damping-off and other diseases.

Many other methods aside from those described are employed in growing tomato plants; whatever the method used, the aim should be to obtain strong, healthy plants sufficiently early in the season so that the plants can be placed outdoors as soon as conditions permit.

Stocky, well-grown, well-hardened plants are well worth the necessary effort required to produce them. Reject all plants that have any appearance of disease, such as mottling of the leaves, curling of the leaves, or discoloration of the stem.

SETTING THE PLANTS IN THE FIELD.

Tomato plants should not be set in the field until danger of frost is past, the actual date depending upon the particular section of the country in which they are grown. It should be the aim of the grower to move the plants to the field with as little shock to them as possible. For this reason, just as much as possible of the root system of the

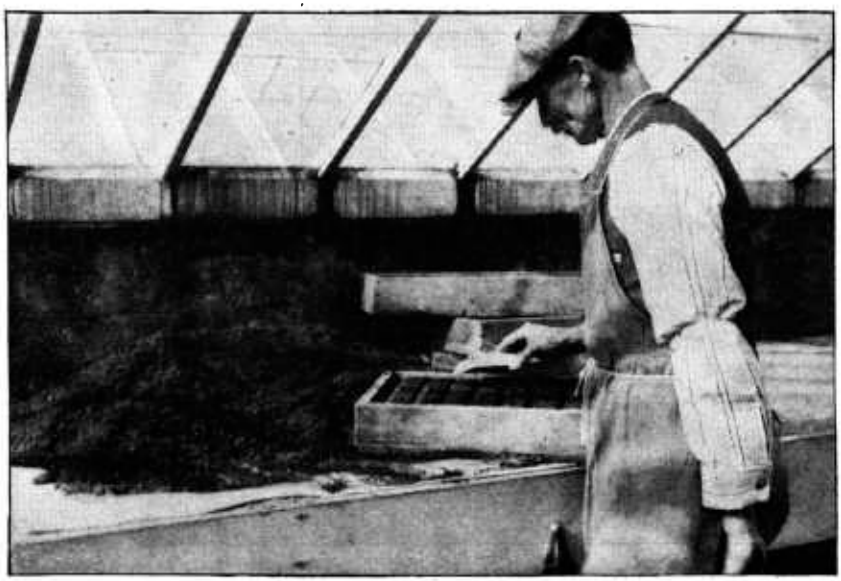

FIG. 4.—Sowing tomato seed in flats in the greenhouse. The seed is covered with sand or leaf mold. As a rule the seedlings are ready to transplant in 10 days.

plant should be saved. Tomato plants grown in such a way that they can be transferred to the field without disturbing the root system have a very great advantage over those whose root systems must be more or less injured in removing them from the seed bed and to the field.

Planting distances vary, but if the plants are to be sprayed or if green crops are to be planted between the rows at the last cultivation the rows should be 6 feet apart and the plants 3 feet apart in the rows. This distance permits the spraying apparatus to pass between the rows without injury to the plants, and it also makes it possible to seed a large proportion of the ground to such crops as crimson clover and rye, when the last cultivation is given the tomatoes. If the plants

are not to be sprayed, they may be set about 4 feet apart each way, or any other distance that gives sufficient room for the development of the individual plants. There is nothing to be gained by planting too close, as the vines will mingle on the surface of the ground, this crowding making it harder to cultivate and gather the crop, with no greater yields than when the plants are set farther apart.

If set in dry weather the plants should be watered in, and it is a distinct advantage to set the plants at a sufficient depth so that but a few inches of the tops will be exposed. Hand planting is necessary where the plants have large quantities of earth adhering, such as is secured by blocking, growing in pots, paper bands, etc. The use of

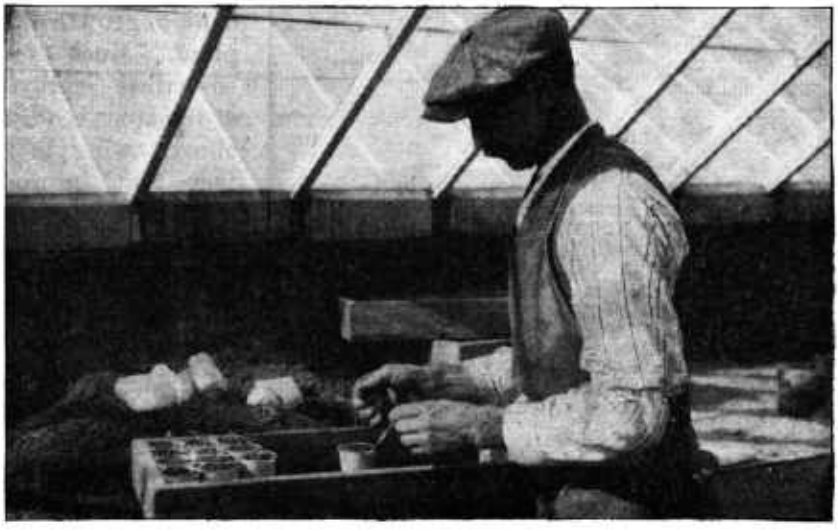

FIG. 5.—Transplanting tomato seedlings to paper pots, which may be set in flats for convenience in handling or set in sand on the greenhouse bench.

transplanting machines is recommended where plants that have not been transplanted are used. The use of water in machine setting is recommended.

CULTIVATION.

Clean, level cultivation is essential to success in growing tomatoes. The field must be kept free from weeds, and it is especially desirable that horse nettle (nightshade) a plant common in some sections of the country and related to the tomato, which spreads certain diseases, be kept out of the field. A good soil mulch should be maintained at all times. The tomato is not a very deep-rooted plant, and frequent shallow cultivations are much better than infrequent deep ones. Cultivation should not be carried on when the vines are

wet, as this tends to spread the spores of the leaf-blight fungus. It should continue until the vines cover the ground, but should be given up when the vines are injured thereby. The hoe should be used to keep stray weeds out of the field after that time.

SPRAYING.

To be effective the spraying of tomatoes for disease must be absolutely thorough. It is an exceedingly difficult matter to spray tomato vines thoroughly, owing to the habit of growth of the plant. Much of the so-called spraying of tomatoes is wasted effort, owing to the fact that improper equipment is used or the work carelessly done. Effective work can be done only with a high-pressure power or traction outfit. Spraying should begin about the time the tomatoes begin to set and should be carried on at intervals of 10 days until five applications are made.

FIG. 6.—A well-rooted, strong, and hardy tomato plant produced by two transplantings. Such plants increase the chances of success.

For additional information on the control of diseases and insects, write to the United States Department of Agriculture or consult the county agent.

PICKING AND HANDLING TOMATOES.

Tomatoes grown for manufacturing purposes are usually hauled directly from the field to the factory. Although they are to be used immediately, extreme care should be taken in picking and handling the crop. One of the greatest difficulties in the past in the production of high-quality canned tomatoes has been in getting the raw product to the cannery in first-class condition. The industry has

been seriously penalized by carelessness in this respect. The sooner the growers and canners realize the importance of producing a high-quality product, and that such a product can be secured only through the exercise of painstaking care all along the line, the better it will be for the industry.

Tomatoes should be picked when in prime condition for the purpose for which they are to be used. This means that they should be thoroughly ripe, but not overripe. All tomatoes injured or partly decayed should be discarded. It should be the aim of the grower to pick his tomatoes and get them to the cannery in the shortest possible time. It should also be the aim of the cannery to handle the product

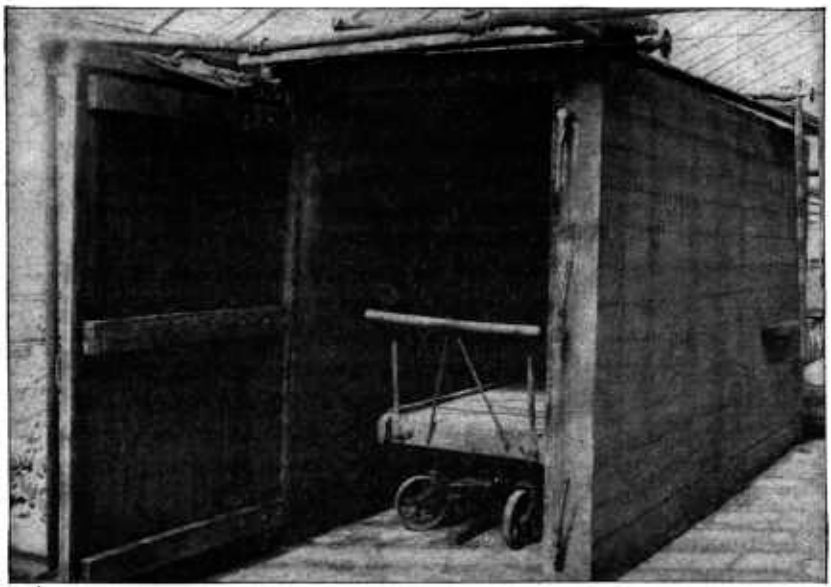

FIG. 7.—A concrete cabinet used for sterilizing soil for the growing of tomato plants.

just as quickly as possible after it reaches the factory. In the past there has been a tendency among growers to pick at too infrequent intervals and among canners to allow the tomatoes to stand around the factory too long before being used.

Tomatoes should not be picked when the vines are wet, as there is great danger that leaf-spot and early-blight, two very serious tomato diseases, will be spread by the hands and clothing of the pickers.

Successful tomato growing depends on good farm practices, good seed, good plants, proper fertilizer, careful planting, clean cultivation, and disease control through spraying and through the use of disease-resistant varieties. Growers who pay due attention to these factors produce crops which give them satisfactory returns.

HOW TO DO IT

DO YOU WANT practical suggestions on how to build a silo, a hog house, a poultry house, a potato-storage house, or how to make a fireless cooker, or other farm home convenience? Are you seeking ideas on how to prepare vegetables for the table, how to care for food in the home, how to bake bread and cake and other appetising foods in an efficient and economical manner? Is there some practical question about your corn or wheat or cotton or other crops, or about your poultry or live stock, to which you are seeking an answer? The answers to thousands of such questions and practical suggestions for doing thousands of things about the farm and home are contained in over 500 Farmers' Bulletins, which can be obtained upon application to the Division of Publications, United States Department of Agriculture, Washington, D. C.

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