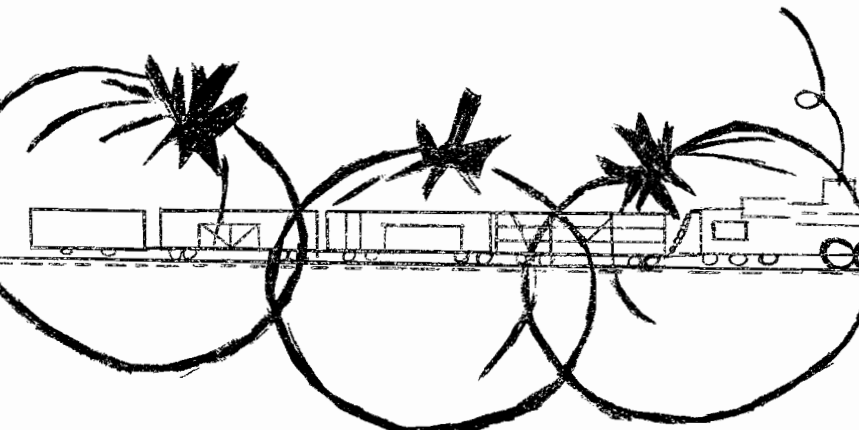
TOMATO PRODUCTION IN STANISLAUS COUNTY



TOMATO PRODUCTION IN STANISLAUS COUNTY

by
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The tomato crop in Stanislaus County is one of the major cash crops with an annual value of about nine million dollars. Acreage fluctuates to a certain extent with an average of about 12,000 acres. Usually one-third or more of the acreage is planted for the fresh market and harvested at mature-green stage or "greenwrap."

Most of the shipping-tomatoes are harvested in October with some shipped in November when temperature and percipitation permits. There is less over-lapping from other growing areas in October and early November on our Eastern markets.

Tomatoes for manufacture are grown on a contract basis for the canneries. Growers who are primarily in the fresh fruit business have a satisfactory, mutually beneficial relationship with canneries. The tomato-canning season usually runs from September 15 to November 1.

TEMPERATURE GROWTH REQUIREMENTS

Since the tomato is a warm season plant, a long-growing season is necessary to harvest all of the crop. Planting starts in March and harvest extends into the latter part of October. Tomatoes are not well adapted to temperatures over 80 degrees F. Fruits and vines are damaged at temperatures of 30 degrees.

Night temperatures that fall below 55 degrees F. for several hours or day temperatures over 100 degrees F. often cause open blossoms to fail. The high temperatures affect the pollen as well as the female parts.

PER CENT OF TOMATO SEEDLINGS PRODUCED AT DIFFERENT TEMPERATURES

Temps.	32°	41°	50°	59°	68°	77°	86°	95°	104°
No. seedlings from 100 seeds	0	0	98	98	98	97	83	46	0

DAYS FOR TOMATO SEED TO EMERGE OR BECOME SEEDLINGS

Temps.	32°	41°	50°	59°	68°	77°	86°	95°	104°
Days	0	0	42.9	13.6	8.2	5.9	5.9	9.2	0

SOIL PREFERENCE

Tomatoes should, if possible, be given the preference of deep, mellow soils with good internal drainage and good surface tilth. Westside soils with these characteristics are the Sorrento and Mocho series. These characteristics can be retained if good rotations are followed and soils are not worked when too wet. Rincon, Denverton, and Ambrose soils are somewhat more difficult to handle, largely from an irrigation standpoint.

On some Westside soils we find a dense, nearly impermeable layer at 18 to 24 inches. This layer inhibits the rapid infiltration of irrigation water into and through the root zone. Lighter, coarse-textured, even gravely loam, soils many times are preferred to the heavy, tight, impermeable soils for tomatoes.

The Westside has been mapped so a grower can get a reasonably good idea of what to expect from any particular piece of land. The map even shows many of the small variations in a field. A soil tube or soil auger or even a shovel will help a grower determine the deeper, physical characteristics of a soil.

The ideal soil permits roots and water to penetrate easily to a six-foot depth.

IRRIGATION

Proper irrigation is probably the most difficult, single operation involved in growing a crop of tomatoes. Tomatoes can be expected to have a rooting zone to a six-foot depth on mellow soils. On heavier, less permeable soils it is often impossible to adequately irrigate the crop without at least some root damage. On these soils light, frequent applications and alternate furrow irrigation sometimes help to save the root system.

Some growers use wide, flat furrows to avoid tire packing on the sides of the furrows. Others use deep furrows with shanks to scarify the sides. Certainly, there is no simple answer to adequate irrigation on the more troublesome soils. A deep, well-filled root zone, just previous to the first picking, will usually carry the crop through to completion.

NORMAL WATER REQUIREMENTS FOR IRRIGATED TOMATOES IN ACRE INCHES PER ACRE

JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	TOTAL
3.2	4.5	7.0	5.2	4.1	—	24.0

Deep subsoiling helps penetration the first 2 or 3 irrigations. Adequate soil moisture should be maintained at all times to help produce high quality fruit, to avoid blossom-end rot, and small fruit. Extremely rapid growth is thought to increase the incidence of "puff."

Usually tomatoes are over-irrigated before fruit set and under-irrigated during the latter part of the growing season. A saturated rooting area may suffocate the plants and often sets the plants up for Phytophthora root-rot. Irrigation needs will vary widely between fields or within the same field. Sets with sand or gravel spots should be irrigated to suit the greatest area involved.

FIELD CULTURE

Fields intended for tomatoes can well be plowed in the fall and left rough. The land should be carefully leveled so the plants may be evenly irrigated. In the spring, discing and floating will kill the weeds and pulverize the soil. A rough seedbed is to be preferred over a smooth fine bed that will crust.

Moisture is usually maintained under and near the clods creating desirable conditions for emergence and seedling protection. During the seedling stage, there is more chance of heat injury in a finely pulverized seedbed.

The most common interval between rows is five feet. Some growers vary this practice with intervals of 7 and 3 feet, or 6 and 3 feet, and even closer with the idea of only one or two irrigations in the narrow intervals. This system may have some merit in preventing mold. With some of the new varieties intended for machine picking, two rows are planted close together and the overall spacing suited to the particular harvester.

Intervals between plants in the row have been reduced to about 12 inches. These closer plantings have tended to reduce the weed hazard and sunburn and is thought to increase yields. Four to six ounces of seed per acre are commonly used at a depth of 3/4 to 1-1/2 inches. Soil temperatures may vary the amount or seed used. Practically all commercial seed is treated before packaging to kill seed-borne diseases and to help prevent damp-off.

Ideal temperatures for germination are between 60 and 75 degrees F., 10 degrees above or below these soil temperatures tend to reduce germination considerably.

Excessive irrigation, when soil temperatures are low, does not increase germination or speed it up. It may even hinder germination and seedling growth.

FERTILIZER

Previous management and soil fertility variations make general recommendations impossible. Most Westside Stanislaus County soils respond to nitrogen-phosphate fertilizer placed under the seed at planting time. More rapid emergence and seedling growth have resulted from an application of 125 to 150 lbs. of 16-20-0. Many of the growers make additional applications of 30 to 60 pounds of actual nitrogen shortly after the first set of fruit. Excessive amounts of nitrogen at fruit set may cause excessive "puff."

There is very little, if any, evidence that phosphate applications made after plant growth has become well started are of any value. At least we have never been able to prove it is worth while. An application of phosphate fertilizer at seeding time usually results in earlier ripening and heavier first picking. We have never been able to show even slight response in yield or planting quality to potash.

WEED CONTROL

Many of our shipping-tomato fields are planted or irrigated up in May and June when temperatures are ideal for watergrass germination as well as other summer weeds. Tomato seeds may be planted slightly deeper than normal at this time of year. This permits more weeds to emerge before the tomatoes.

Carrot Oil - A day or a day and a half before tomato emergence or when only a few tomato plants have come through, a directed spray of carrot oil at 9 or 10 gals. per acre will eliminate practically all the weed seedling at low cost.

Tillam - A selective weed control material, Tillam, has shown excellent weedicide properties when incorporated in the soil either at preplant or planting time. A 4-lb. per acre rate with 40-60 gal. of water is recommended. Band application in the row makes an economical weed control practice.

Phosphate placed under the seed at planting time may speed seedling growth to the point where weeds are not the problem found in slower fields.

HARVESTING & HANDLING

As a fruit matures, there are changes in color, texture, and taste. Most of the growth occurs in the green fruit. After maximum size has been reached there are changes in color and feel of the fruit. Picking of mature green fruit is not an easy matter. A grower looks for the following characteristics in greenwraps.

- Maximum size for variety
- Development of a corky stem scar
- Skin on a mature fruit is not easily rubbed off
- Seeds are not cut with a sharp knife on cutting through a fruit
- Pulp around the seeds has become gelatinous

The next stage is a breaker, showing light color at the blossom-end followed by so-called "pink", then table ripe followed by complete ripeness desired by the canneries. Tomatoes, approaching the breaker stage, result in a more uniformly high quality when artificially ripened than those picked at the lower end of the green mature stage.

Canneries prefer fully ripened tomatoes with no white tissue. Average daily temperatures between 60 and 80 degrees F. are ideal for rich, red color. Fruits ripen well at higher air temperatures if they have adequate foliage. Field temperatues from 40-45 degrees F. will not affect the appearance of greens at picking time but may cause decay during shipping or in the ripening rooms.

Mature greens are picked with a wide range in maturity. This results in uneven ripening, making it necessary for them to be graded for color when placed in the ripening rooms.

VARIETIES - Canning

VF 14 - is an excellent variety for canning. It yields well and sets under adverse conditions; it has good color, is reasonably firm, is about the size of VF 36 and has a large vine and good canopy.

VF 36 - is an average-sized tomato, has compact vine, yields very well, early, is inclined to yellow butt, and has tight stems. VF 36 sets well under adverse conditions. Some acreages of VF 36 will give way to VF 14.

VF 1402 - has good yield potential, has a large vine and fruit has a heavy core. High temperatures keep it from setting.

VF 145 types -- have several good qualities. They set well under adverse conditions, are good yielders and have good-holding ability. The fruits are small and firm.

Many plant breeders are working to develop the characteristics they feel should be incorporated in a good canning tomato. If or when the time comes when mechanical harvesters are used extensively, the VF 145 lines will probably be used more than they are at the present time.

VARIETIES - Shipping

Early Pac 7 (V-F susceptible) is still the most popular shipping tomato. It is round and smooth, has good external color and is most attractive. It has neither verticillium nor fusarium resistance and runs to small sizes, especially late in the season.

Ace - (V-F susceptible) is a popular shipping variety. At times it cracks badly and may catface. Usually Ace produces a large percentage of round, smooth and attractive tomatoes. It sizes well and maintains size late in the season--better than Early Pac 7.

A-1 (F. Susceptible) - is a large, late variety that maintains size throughout the season. It does not have the smooth attractiveness of either Ace or Early Pac 7 and runs rather high to number 2's. However, the percentage of 6x6's and larger is very high.

Pearson S - (V-F Susceptible) has lost considerable popularity. It does produce an abundance of smooth, attractive, well shaped fruit that ships well.

Early Pac 7, Ace and Pearson are still the shipping varieties used most extensively. With the incorporation of Verticillium and Fusarium resistance, they may be around for several years for they do have many of the desirable characteristics shippers and consumers want. There is, however, plenty of opportunity for plant breeders to improve the percentage of marketable fruit, internal color, uniformity of size and ability to set fruit under adverse conditions.

The following information is the result of one year's operation on 2,000 acres of fruit. This fruit was grown on several fields with wide variations of soil. Information was gathered from the total pack of four shippers.

Variety	No. 1's	No. 2's	No. 1's 6x6 and larger	No. 1's 6x7 and smaller
Early Pac 7	82%	18%	44%	54%
Pearson S.	86.8%	13.2%	42%	58%
Imp. Pearson	82.0%	18.0%	41%	59%
A-1	63.0%	37.0%	65%	35%

CHILLING OF TOMATOES AND RIPENING RESPONSES

The chilling of greenwrap tomatoes may occur in the field, in transit, or at destination. Our late shipments are usually crowding the danger point. However, this is a calculated risk that growers and shippers must take to stay in the business. Late in the season with a considerable number of hours of low temperatures in the field the transit temperature should be higher.

If the number of hours below 60 degrees during the week prior to harvest is less than 95, there appears to be little harm from field chilling.

If chilling damage is evident upon ripening, it is likely that most or all of it occurred during transit. If the number of hours below 60 degrees is between 95 and 115 hours one can expect a lower percentage of marketable fruits and the fruit should not be kept at temperatures below 50 degrees or decay will increase and ripening will be inhibited.

The 60 degree temperature we use as a guide takes into consideration the likely extremes above and below this temperature and the duration of these temperatures. From the readings on the graphs recorded in several fields in the Patterson area, it takes several hours to reach the low temperature but the rise, especially on clear days, is very rapid.

The low temperatures may be of short duration on clear nights and may reach a considerably lower temperature than during cloudy weather. During cloudy weather the temperatures may not reach extremely low levels or very high temperatures during a 24-hour period, but the hours below 60 degrees may be the same.

These conditions have all been taken into consideration to arrive at the 60 degree point as a base for

accumulated cold hours during seven days previous to harvest. Market conditions and basis of sale will determine the justification for picking greenwraps after the accumulated hours below 60 degrees F. have reached 120 or 125 during this seven day period. As the accumulated hours below 60 degrees in the field increase, the transit temperatures should increase. With 114 hours below 60 degrees ripening may turn out something like this:

TRANSIT TEMPERATURES	MARKETABLE FRUIT
62 degrees	55 per cent
55 degrees	30 per cent
50 degrees	26 per cent
41 degrees	3 per cent

These studies will never develop into an exact science but certainly will give the grower and shipper a guide by which his judgement is greatly improved.

ROOT-KNOT NEMATODE CONTROL

Tomato growers have been stripping tomato fields with Nemagon for several years at their own RISK. Applications of 1.5 to 1.75 gals. of 25% Nemagon per acre have been made with shanks on both sides of the row at planting time. Placement has been 4 to 6 inches from the seed and 6 to 8 inches deep. Shanks and planters are attached to the same tool-bar to insure percision location. Growers hold off irrigation at least 5 days. This method of control has been used on many farms. None of the plantings showed any visible evidence of phytoxicity.

Strip application at planting time is not a University of California recommended practice because of the limited types of soil on which it has been used. This method may warrant consideration or limited use where soils are not heavily infested. Most growers favor solid treatment.

TOMATO DISEASES

Verticillium wilt is becoming more widespread each year. New land is most desirable for tomato production. After a year or two of tomatoes, there is usually a high incidence of verticillium wilt.

The older leaves on the plant die prematurely. A brown discoloration is found in the woody stem cylinder. Infected plants may wilt temporarily following a heavey irrigation. Verticillium has many hosts including some weeds. Wilt-infected fields often produce fair crops but seldom good yields.

Fusarium Wilt is not so sidely spread in Stanislaus County as Verticillium. This particular strain affects tomatoes only. It MAY be seed-borne. Temperatures of 80 degrees F. and above seem to be most favorable. Leaves of infected plants turn yellow, usually on one side of the plant first and the whole plant usually dies prematurely.

Phytophthora root-rot is a fungus that developes rapidly under favorable moisture and temperature conditions. It probably causes greater losses to tomato growers than any other disease organism. On many of our heavy soils it is extremely difficult to control. However, heavy frequent irrigations should be substituted by minimum applications that will adequately supply moisture to the growing crop. Some irrigation practices that have reduced root-rot on heavy soils are: deeper furrows, alternate furrow applications, shorter runs, less frequent watering and for shorter periods.

In problem fields nothing will take the place of pre-irrigation examination of the root zone to a depth of $3\frac{1}{2}$ to 4 feet. A tensiometer or a soil auger is a must for good moisture determinations. Soils should never remain water-logged for over a day and a half or root damage is greatly intensified.

TYPICAL COSTS OF GROWING AND HANDLING GREENWRAP TOMATOES
Westside - Stanislaus County
100 Acre Tomato Operation on 400 Acre Farm
Yield per acre 7.5 Tons Fresh Fruit
Equipment, Field, Hoe and Thinning Labor: $1.25 per hour

Operation	Hours per Acre	Labor	Fuel and Repairs	Material	Contr. Service	Total Cost per Acre	
Disc	.25	.31	.64			.95	
Subsoil	2.00	2.50	5.10			7.60	
Plow	.75	.94	1.91			2.85	
Disc	.25	.31	.64			.95	
Plant & Fertilize - 2 men, 3 rows	1.00	1.25	.58			1.83	
Springtooth	.15	.19	.38			.57	
Landplane	.66	.83	1.65			2.48	
Harrow (spike)	.25	.31	.58			.89	
Seed				6.50		6.50	
Spray Insecticide					18.00	18.00	
Water-Power to Pump				18.00		18.00	
Prepare to irrigate - 4 men	.40	.50	.90			1.40	
Fertilizer				15.50		15.50	
Grade in ditches - 2 men	.20	.25	.45			.70	
Cultivate 3 rows	.50	.63	.53			1.16	
Thin & weed	18.20	22.75				22.75	
Cultivate	.30	.37	.32			.69	
Chisel & Furrow out rows	.50	.63	.53			1.16	
Prepare to irrigate	.40	.50	.90			1.40	
Grade in ditches -2 men	.20	.25	.25			.50	
Cultivate	.40	.50	.45			.95	
Hoe	4.00	5.00				5.00	
Prepare to irrigate	.40	.50	.90			1.40	
Hoe	2.00	2.50				2.50	
Irrigate 6x	5.6	7.00				7.00	
Grade in ditches - 2 men	.20	.25	.25			.50	
Stake, cut & regrade roads	.50	.63	.45			1.08	
Misc. other work	3.00	3.75				3.75	
Pickup truck, plus 10%			1.27			1.27	
Total Cultural	42.11	52.65	18.68	40.00	18.00	129.33	$129.33

Miscellaneous and overhead

Misc. costs - office telephone, hand tools, boots, interest on operating capital, etc. @ 6.5% of cost	23.07	
Taxes on P. P.	1.48	
Insurance - Fire and Liability	1.40	
Land rent at $75.00 cash	75.00	
Depreciation of equipment & housing (1/2 of 37,825)	12.10	
Interest on equipment & housing (1/2 of 37,825)	3.08	
Total	116.13	$116.13

Harvest

Packing	1.25 per 40# carton	260 per acre		325.00	
Selling	11 per package	260 per acre		28.60	
Pick, load & haul per field box		35 cents per box			
additional cost on Nationals		05 cents	350 per acre	140.00	
				493.60	$493.60

TOTAL COST $739.06

TYPICAL COSTS OF GROWING AND HANDLING CANNERY TOMATOES

Westside Stanislaus County

100 Acre Tomato Operation on 400-Acre Farm

Yield per acre 20 tons

Equipment, Field, Hoe and Thinning Labor: $1.25 per hour

Labor & Cash Cost per Acre

OPERATION	Hours per Acre	Labor	Fuel & Repairs	Contro. Service & Material	Total	
Disc 2x	.5	.62	1.44		2.06	
Subsoil	1.5	1.87	3.50		5.37	
Landplane	.66	.85	1.87		2.72	
Springtooth 2x	.3	.37	1.15		1.52	
Harrow	.25	.31	1.05		1.34	
Plant & Fertilize - 2 men	1.0	1.25	.58		1.83	
Ditching 3x & prepare to irrig.	.6	.75	2.10		2.85	
Seed				6.40	6.40	
Fertilize (total)				15.50	15.50	
Insect Control				24.00	24.00	
Thinning - hoe 2x	24.2	30.25			30.25	
Cultivate 3x	1.2	1.50	2.05		3.55	
Chisel & Furrow out	.5	.63	.70		1.33	
Irrigate 7x	7.	8.75			8.75	
Water & Power to pump				23.00	23.00	
Grade in Ditches 3x	.6	.75	2.10		2.85	
Stake-cut-grade roads	.5	.63	.60		1.23	
Misc. other work	.3	3.75			3.75	
Pickup truck, plus 10%			1.27		1.75	
Total	39.11	52.28	18.41	68.90	140.05	140.05

Misc. Cost		
Office telephone, hand tools, syphons, dams interest on operating capital at 6.5%	23.00	
Taxes PP	1.46	
Insurance - fire and liability	1.30	
Land Rent	75.00	
Interest on equipment and housing - 1/2 of 37,825	3.31	
Depreciation on equipment and housing	12.10	
Total	$116.17	$116.17

Harvest		
Box Rent	8.00	
Picking	138.00	
Loading	17.00	
Labor Supervisor	17.00	
Labor (not picker)	5.00	
Recruit & transportation, extra help, camp charges, etc.	12.00	
Dockage, Rejects, Inspection	16.40	
Total	$213.40	$213.40

$469.62

Four times have not been included 1) Nematode control which varies greatly in cost, depending on method of application; 2) Social Security; 3) Compensation Insurance and, 4) Disability Insurance.