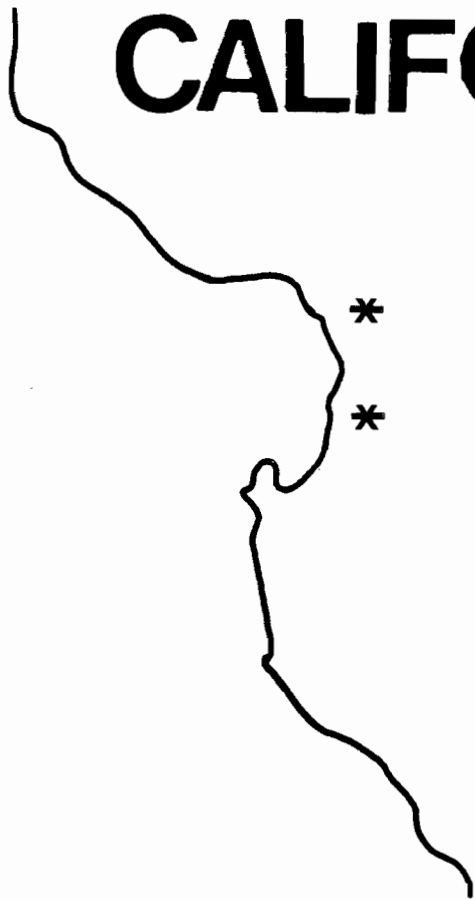


# **STRAWBERRY PRODUCTION AND COSTS IN THE CENTRAL COAST OF CALIFORNIA**



santa cruz county

**WATSONVILLE**

**SALINAS**

monterey county

**AGRICULTURAL EXTENSION  
UNIVERSITY OF CALIFORNIA  
1985**

Written By

N.C. Welch, Farm Advisor, Santa Cruz County  
A.S. Greatehead, Farm Advisor, Monterey County  
J.A. Beutel, Extension Pomologist, University of California, Davis

University of California Cooperative Extension

Revised 1985

See STRAWBERRY PRODUCTION IN CALIFORNIA, Leaflet 2959, for more detailed instructions on growing strawberries statewide.

The University of California in compliance with the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and the Rehabilitation Act of 1973 does not discriminate on the basis of race, creed, religion, color, national origin, sex, or mental or physical handicap in any of its programs or activities, or with respect to any of its employment policies, practices, or procedures. The University of California does not discriminate on the basis of age, ancestry, sexual orientation, marital status, citizenship, nor because individuals are disabled or Vietnam era veterans. Inquiries regarding this policy may be directed to the Affirmative Action Officer, Division of Agriculture and Natural Resources, 2120 University Ave., University of California, Berkeley, California 94720 (415) 644-4270.

**Cooperative Extension Work in Agriculture and Home Economics, U.S. Department of Agriculture, University of California, Santa Cruz County Cooperating**

## STRAWBERRY PRODUCTION IN THE CENTRAL COAST AREA OF CALIFORNIA

Total strawberry acreage in the Central Coast area has varied from 4,300 to over 4,800 acres in recent years. Favored by cool summers, per acre yield of strawberries in this area is the highest in the world. This is because cool temperatures during the summer help promote flower bud development even under long day conditions. Successful plant breeding programs have developed high quality varieties adapted to this area.

### SOIL

Strawberries prefer well drained sandy loam soil, but with good drainage and management high yields of berries can be obtained on other soil types. Strawberry plants are one of the most salt sensitive crops grown in this area. Soil salts should be below 400 ppm. Soils with a high water table cause root rot and plants die out. Soil pH 6 to 7.3 favors best production. Low frost pocket areas should be avoided because of late spring freezes in these locations.

### LAND LEVELING

The field should be leveled to a one to two percent slope for drip irrigation. This slope also helps to quickly remove water from winter rains. Irrigation runs should not exceed 150 feet for efficient water use and for picking.

### SOIL FUMIGATION

Soil fumigation for disease and weed control is a routine practice by all strawberry growers. Higher berry yields result when the soil is treated with a mixture of methyl bromide and chloropicrin. For maximum results, soils to be fumigated should be low in moisture (not wet), in seedbed tilth, low in organic matter, free of plant residue, free of clods, and above 52°F. Continuous plastic tarps help hold in fumigant and should not be removed for at least 48 hours. Fifteen days or longer should lapse after plastic tarp removal, depending upon soil type, moisture and temperature, before transplanting to insure that no phytotoxic residues remain in the soil.

### BED PREPARATION

For summer plantings the beds are listed up on 44 to 52-inch centers. Bed width will depend upon plant spacing, variety and methods of handling labor. Beds 8 inches or higher are desirable, as this helps drainage and soil aeration that prevents root rot and salt buildup. Bed tops should be level and have a uniform slope. Avoid tilted or dips in the beds and furrows as these areas are more susceptible to disease and poor vigor. Extra effort in tractor work making beds and furrows smooth and even will pay big dividends later.

### PLANTING

Beds are premoistened by sprinkling. Deep, narrow grooves are then opened in the beds by using a specially constructed disk. Plants are hand-planted into the grooves so the crown is at the soil surface. Planting plants too high or too low result in poor vigor or die out. Grooves are closed by using a special press wheel. Then dirt is settled around root by immediate sprinkling.

## SPACING

Various spacings are used by growers. Two rows 14 inches apart with plants 8 to 11 inches apart on a 48 to 52-inch bed are used in many fields. A planting of 4 rows on a 60-inch bed is used in a few winter planted fields. Plant population, depending upon varieties for summer planting, of 18-21,000 per acre is needed for highest yield.

## PLANTING DATES

Summer plantings using properly stored plants are: Chandler, Pajaro-- August 20 to September 1; Aiko--August 25 to September 5; Selva--September 20 to October 10. Winter planting with mature, recently dug plants: Chandler--November 1 to November 8. Selva for winter plantings should be given 3 weeks of cold storage (34-36°F) before planting.

## VARIETIES

Pajaro, Aiko, Chandler and Selva are the main varieties grown in this area. Aiko is a late high yielding variety that starts producing in early May and continues until November. Pajaro produces almost 95% fresh market fruit and on cool summers will produce until late September. If heat spells occur this variety will stop producing before mid-August.

Chandler is a new early variety with a tendency to overgrow by mid-summer. This variety produces very large yields of mixed size, high flavor fruit on summer planting. Selva is a day neutral that produces a very hard berry. It tends to hold it's fruit size throughout the season. This variety is still being market tested and is very susceptible to mites.

## IRRIGATION

Immediately following transplanting, the fields should be sprinkled to settle the soil around plant roots. Summer-planted fields will benefit from light sprinkler irrigation every other day for eight or more weeks. Strawberries for top production require frequent, light applications of water low in salts (below 600 ppm). During harvest seasons, irrigate 1-2 times per week. For each acre of strawberries, you will need a minimum of 15 gallons of water per minute for peak water usage periods unless you have a reservoir.

## FERTILIZATION

After leveling, most fields are broadcasted with 1-2 tons lime or gypsum. This should be thoroughly incorporated into soil. We do not recommend broadcasting of fertilizer because too often growers light disk or chisel the ground to incorporate these salty chemicals. This practice has resulted in very severe plant damage because as the beds are folded in, these salts are then banded in the center of the bed causing poor vigor and die out. Sidedressing fertilizer into the bed away from roots of summer planted strawberries is the safest way to apply phosphate, potassium and some nitrogen. Some growers will place slow release nitrogen just below root system in the planting slot just before planting; 16-20 plus N-Serve can be used this way if it is not in contact with root system. Manure should not be applied within three months before planting, if at all.

Summer-planted fields should not be fertilized after transplanting with nitrogen until plants are growing actively. Nitrogen needs will vary from 180 to 280 pounds per acre, depending upon the variety and past crop history. Nitrogen, when applied as a sidedressing after planting,

except for the slow release types, should be applied in small amounts of 40 pounds or less per acre at any one time. Some nitrogen will need to be applied in the water during the summer to carry the plants through to the end of harvest. Selva variety will need more nitrogen during harvest period than non-day neutral varieties.

In winter-planted fields, nitrogen as 16-20 + N-Serve or slow release should be placed in the planting groove using 140-200 lbs. N prior to planting and covered with 1/2-inch of soil to prevent root burn.

#### PLANT MAINTENANCE

Plants transplanted in the summer will produce runners and some flowers that will need to be cut off to help promote large multiple crown growth. High moisture levels in the soil will be needed during the first 8 to 10 weeks of growth during hot weather. After the plants have been growing for two to three weeks, nitrogen can be applied if field has not been slot fertilized.

#### PRUNING

Remove only dead or dying leaves, as removal of functional leaves will reduce yield. This is especially true in late plantings, or when the plants are weak. Never prune before very late January.

#### PLASTIC MULCH

In summer-planted fields, plastic mulch can be laid down in February, unless you have planted late or plants are very weak, then plastic should be laid down in early December. Some larger outer leaves are removed to help reduce labor costs when applying plastic. Winter-planted fields should have the plastic mulch applied as soon as the plants become established to stimulate early growth for development of flower buds in the crowns under short day length conditions. Plastic sheets should cover top and shoulder of beds. This cover will need to be anchored every 8 to 10 feet with a shovel full of dirt or the use of wire, plastic or wooden holders.

#### HARVEST

Strawberry harvest, depending upon variety and location, may begin in mid-April and continue through most of the summer. Picking carts holding a crate with 12 baskets are pushed through the field by pickers. A crate will hold approximately 11 to 12 pounds of berries. Maturity of berries picked will depend upon how far they are to be shipped and the variety. Selva variety should be picked mostly colored because of its very firm texture and marginal flavor. Processed berries are picked fully ripe with stem and calyx removed and placed in trays without baskets.

#### DISEASES

Strawberries are attacked by a variety of leaf, fruit, crown and root diseases. For control of diseases, contact your local Farm Advisor for the latest recommendations.

#### INSECTS

Mites (two-spotted and cyclamen), various worms, aphids, lygus bugs, root weevil and snails can be serious pests of strawberries. Contact your local Farm Advisor for the latest chemical controls.

## MANAGING SECOND PRODUCTION YEAR

About 33% of the strawberry plantings are kept for a two harvest season.

### CULTIVATION

Strawberry furrows are usually cultivated in early spring to control weeds and to break up the surface compacted layer. Only a very minimum amount of cultivation is needed in established plantings.

### FERTILIZATION

Fertilizer placement after the plastic mulch has been applied is limited to irrigation water. Nitrogen so applied follows water movement and can be leached below the root zone. Apply nitrogen before the cold fall weather and in the spring as plants begin to grow; 20 to 30 lbs. of nitrogen per month may be needed in some fields.

### PRUNING

Many second year fields are oiled in late January. This helps kill certain overwintering insects and aids leaf removal by killing most of the green leaves. The Aiko variety is sensitive to oil under some conditions and should not be treated. In early February, the plants are pruned by mechanical rotobearer and/or by hand. All but the very small center leaves should be removed from the plants and destroyed as a sanitary measure.

### IRRIGATION

Irrigation is the same as first year berries. Salts may build up in some soils. These fields may need to be sprinkler-irrigated in years of low rainfall to leach salts below the root zone in February and March.

### PEST CONTROL

Diseases and insects tend to build up more in second year plantings. Care should be taken to start the year with very low populations of mites, root weevil and slugs.

### PLASTIC REMOVAL

At the completion of the harvest season, remove the plastic mulch. This material breaks down slowly in soil and causes numerous problems in preparing and managing soils for the next crop.

### YIELDS

Chandler and Pajaro are capable of producing 4,500-7,000 trays of fresh market strawberries in the first year of production if grown properly. The Aiko and Selva varieties have the potential of producing 8,000 or more trays of fresh market strawberries in years with normal winter temperatures. Yields of Aiko have been recorded as high as 10,000 trays per acre.

STRAWBERRY SAMPLE COST - 10 acre in production  
ESTABLISHMENT COST PER ACRE  
 August - December 1985-86

	<u>Hours Per Acre</u>			Cost per Acre
	Labor Hour	60 h.p. Tractor	30 h.p. Tractor	
Plow, disk, subsoil, pre-fertilize	7	7		168.84
Survey for leveling, 4 hrs @ 18.00/hr				72.00
Leveling and grading 3X	7	7		168.84
Chisel 3X	3	3		72.36
Sprinkle 1X	2			14.40
Plastic removal-fumigation and disposal				51.74
List beds	2		2	25.76
Sprinkle-preplant 2X	2		1	20.08
Shape beds and open plant furrows	3		3	38.64
Transplant and close plant furrows	38		4	296.32
Bed and furrow maintenance	3		3	38.64
Pest control 5X	5		5	64.40
Irrigate-sprinkle 8X and pipe removal	15		5	136.40
Cut runners 3X and blossom weed 2X	49			352.80
Fertilize 1X	2		2	25.76
Replant (5% stand)	6			43.20
<b>Total Cultural Labor and Field Power</b>	<b>143</b>	<b>16</b>	<b>26</b>	<b>\$1,590.18</b>
<b>Materials:</b>				
Water 8X				22.00
Fumigation contract				1200.00
Preplant fertilizer				200.00
Plants (plus fungicide) 19,950 @ 29.58/1000 plus 5% replant				622.12
Fertilizer slow release				320.00
Pest control 5X				167.00
Drip system - 5 year drip filter pipes - \$100/year + drip line 1800 ft. - 48" bed 18¢/ft				424.00
Rent - 1 crop every 2 years - \$400.00/year				800.00
<b>Total Material Cost</b>				<b>\$3,755.12</b>
<b>Total Cultural Labor, Field Power, and Materials Costs</b>				<b>\$5,345.30</b>
General Expenses: office, phone, insurance - estimate 10% of above				530.87
Trucks				172.00
Repairs				63.40
<b>Total Cash Overhead</b>				<b>766.27</b>
Interest on Working Capital (average of 10%)				743.73
<b>TOTAL CASH COST</b>				<b>\$6,855.30</b>
<b>Investment</b>	<b>Per Acre</b>	<b>Depreciation</b>	<b>Interest 14% on 1/2 Cost</b>	
Building	160.00	16.00	11.20	
Irrigation-sprinkler	884.00	88.40	61.88	
Power equipment	2600.00	260.00	182.00	
<b>Total Investment and Interest</b>		<b>364.40</b>	<b>255.08</b>	<b>619.48</b>
<b>TOTAL COST TO ESTABLISH STAND</b>				<b>\$7,474.78</b>

Labor costs, including fringe benefits and bookkeeping are figured at the following hourly rate: Labor \$7.20. Cash costs of fuel, oil, repairs for 60 h.p. diesel crawler \$16.92 per hour, 30 h.p. wheel tractor \$5.68 per hour.

STRAWBERRY SAMPLE COST PER ACRE  
FIRST YEAR FRUIT HARVEST

	Labor Hour	Hours Per Acre		Cost per Acre
		30 h.p. Tractor	Sprayer	
Pruning and weeding	38			273.60
Plastic mulch	24	4		195.52
Pull plants through plastic 2X and weed	15			108.00
Irrigate 38X and repair drip system	38			273.60
Weed and runner cut 3X	34			244.80
Pest control 10X	10	10	10	177.50
Miscellaneous	10	2		83.36
<b>Total Cultural Labor and Field Power</b>	<b>221</b>	<b>12</b>	<b>10</b>	<b>\$1,356.38</b>
Plastic mulch				135.00
Pest control 10X				482.00
Water - 2.5 acre feet at \$22/acre foot				55.00
<b>Total Material Cost to Harvest</b>				<b>\$ 672.00</b>
<b>Total Labor, Field Power and Materials</b>				<b>\$2,028.38</b>
General Expenses: office, insurance, tax, etc., estimate 12% of above				289.39
Trucks				264.00
Repairs				159.80
<b>Total Cash Overhead Costs</b>				<b>\$ 713.19</b>
Interest on Working Capital (average of 10%)				292.47
<b>Subtotal Cultural Cost Except Harvest</b>				<b>\$3,034.04</b>
<b>TOTAL CULTURAL COST EXCEPT HARVEST</b>				<b>\$10,508.82</b>

Harvest Cost: Pick and supervision - estimate \$1.70 per tray; crates, baskets, wires  
.83 = 2.53 total harvesting tray cost.

YIELD VS. COST

Trays Per Acre	Cultural cost per tray	Total cost per tray
4000	2.62	5.14
5000	2.09	4.62
6000	1.74	4.27
7000	1.50	4.02



STRAWBERRY SAMPLE COST - 10 Acre Production - Processing  
SECOND-YEAR FRUIT HARVEST - Oct-July

	Hours Per Acre			Cost per Acre
	Labor Hour	Sprayer	30 h.p. Tractor	
Prune and leaf removal	24		2	184.16
Cultivate and repair roads	2		2	25.76
Fertilize 1X	1		1	12.88
Weed and runner cut	34			244.80
Irrigate 25X	26			187.20
Pest Control 10X	10		10	128.80
Removal old plastic and pipes	9		1	70.48
Disk 2X	2		2	25.76
<b>Total Cultural Labor and Field Power</b>	<b>108</b>	<b>10</b>	<b>18</b>	<b>\$ 879.84</b>
Fertilizer				268.00
Water 2-acre feet				44.00
Pest Control				400.00
<b>Total Material Cost to Harvest</b>				<b>712.00</b>
<b>Total Labor, Field Power and Materials</b>				<b>\$1,591.84</b>
General Expense - 10% of above				164.05
Repair				143.60
Truck				172.00
Rent - 2 crops every 3 years \$400/year				600.00
<b>Total Cash Overhead Costs</b>				<b>\$1,079.65</b>
<b>Total Cash Costs</b>				<b>\$2,671.49</b>
Interest On Working Capital (average of 10%)				263.00
<b>Investment</b>	<b>Per Acre</b>	<b>Depreciation</b>	<b>Interest 14% on 1/2 Cost</b>	
Buildings	160.00	16.00	11.20	
Irrigation equipment	884.00	88.40	61.88	
Power equipment	2600.00	260.00	182.00	
<b>Total Investment and Interest</b>		<b>364.40</b>	<b>255.08</b>	<b>\$ 619.48</b>
<b>TOTAL CULTURAL COST - 2 years</b>				<b>\$3,553.97</b>

Harvest Cost - Labor - Supervision - Bookkeeping - hourly. 18¢/lb includes dockage

Labor costs, including fringe benefits and bookkeeping are figured at the following hourly rate: Labor \$7.20. Cash costs of fuel, oil, repairs for 60 h.p. diesel crawler \$16.92 per hour, 30 h.p. wheel tractor \$5.68 per hour and sprayer at \$4.87 per hour.

YIELD VS. COST	
Pounds/Acre	Total Cost Per Lb.
30,000	.30¢
40,000	.27¢
50,000	.25¢