

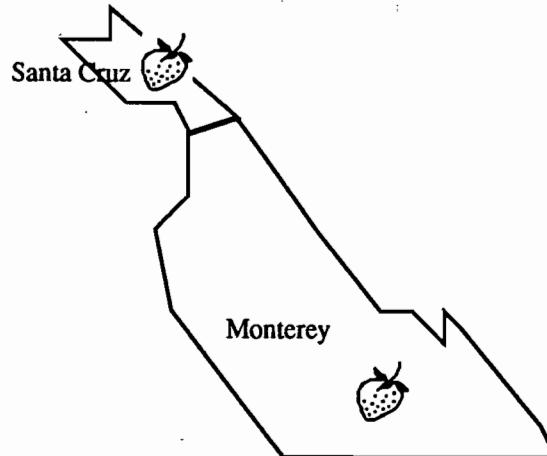


STRAWBERRIES

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Production and Costs of the Central Coast of California

1990



UC COOPERATIVE EXTENSION

University of California
Cooperative Extension

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

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PLANTING

Beds are pre-moistened 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 top of the crown is at the soil surface. Planting plants too high or too low results in poor vigor or die out. Grooves are closed by using a special press wheel, then dirt is settled around the root by immediate sprinkling.

SPACING

Various spacings are used by growers. Two rows 14 inches apart with plants 10 to 14 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. Depending upon varieties for summer planting, a plant population of 18-21,000 plants per acre is needed for highest yield. For winter planting, slightly higher plant populations are used.

PLANTING DATES

Summer plantings using properly stored plants are described in Leaflet #2959. Chandler, Pajaro--August 20 to September 5. Selva, Seascape, Muir--September 25 to October 10. Winter planting with mature, recently dug plants: Chandler (may or may not need additional chilling)--October 25 to November 4. Selva, Seascape, and Muir for winter plantings from high elevation nurseries should be given 3 weeks of cold storage (34-36°F) before planting.

VARIETIES--SUMMER PLANTING

Pajaro, Chandler, and Selva are the main varieties grown in this area. Pajaro produces 95% fresh market fruit and in cool summers will produce until late September. If heat spells occur, this variety will stop producing before mid-August. Seascape, a new release by the University of California is expected to replace the Selva variety.

Chandler is an 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 its fruit size throughout the season. This variety can be very susceptible to mites. For more detail on varieties see Leaflet #2959, "Strawberry Production in California."

VARIETIES--WINTER PLANTING

Selva is the most common variety plant in the winter system because of its day neutral characteristic and its ability to hold its size during mid and late season. This variety can have poor eating quality and should be picked fully colored to help overcome this problem. Poor vigor results in high susceptibility to mites. Winter planted Chandler produces a good crop of early fruit but tends to respond to day length and warm days by producing vegetative growth at the expense of fruit production.

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 400 ppm). During harvest seasons, irrigate 1-2 times per week. For each acre of strawberries you will need a minimum of 10 gallons of water per minute for peak water usage periods unless you have a reservoir.

STRAWBERRY PRODUCTION IN THE CENTRAL COAST AREA OF CALIFORNIA

Total strawberry acreage in the Central Coast area has varied from 5,000 to over 7,100 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. Soil pH 6.4 to 7.3 favors best production. Low frost pocket areas should be avoided because of late spring freezes in these locations.

SOIL PREPARATION

Improper soil preparation is a common practice and contributes to substantial yield losses. Never work the soil wet as this destroys the soil structure and reduces the amount of soil oxygen that is essential for healthy root growth. Deep ripping of dry soil to a depth of 1/2 foot is essential for internal drainage. Addition of salty organic fertilizer is a significant factor in yield reduction if these salts are not leached below the root system before planting.

LAND LEVELING

The field should be leveled to a one percent slope for drip irrigation. This slope also helps to quickly remove water from winter rains. Irrigation runs should not exceed 200 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 cannot be removed for 48 hours. Fourteen 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 soil drainage and aeration which prevents root rot and salt buildup. Bed tops should be level and have a uniform slope. Avoid tilting 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.

FERTILIZATION

After leveling, most fields are broadcasted with 1-2 tons of lime or gypsum. This should be thoroughly incorporated into the 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 vertically in the bed causing poor vigor and die out. Side dressing 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 the 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 the root system. Manure should not be applied within three months before planting, if at all.

Summer planted fields should not be fertilized with additional nitrogen until the 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 after planting, except for the slow release types, should be applied in small amounts of 40 pounds of fertilizer 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 the 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 pounds nitrogen prior to planting and covered with 1 to 1 1/2 inches 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 as they appear 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 the 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 late January.

PLASTIC MULCH

In summer planted fields, a 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 clear 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 the top and the shoulder of the beds. This cover will need to be anchored every 8 to 10 feet with a shovelful of dirt or the use of wire, plastic, or wooden holders.

HARVEST

Strawberry harvest for summer planting will depend upon variety and location. It may begin in mid-April and continue through most of the summer. For winter planting harvest can begin in early March depending upon spring weather and the variety. 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. Selva variety berries should be picked fully colored because of its very firm texture and marginal flavor. Fresh market berries should be in the cooler within two hours of picking. These berries need to be cooled rapidly to 33°F to preserve quality and to minimize arrival problems. Processed berries are picked fully ripe with stem and calyx removed and placed in trays without baskets.

YIELDS

Chandler and Pajaro are capable of producing 7,000 trays of fresh market strawberries in the first year of production of grown properly. The Aiko and Selva varieties have the potential of producing 9,000 or more trays of fresh market strawberries in years with normal winter temperatures.

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. See "Compendium of Strawberry Diseases" by the American Phytopathological Society for detailed descriptions of diseases.

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 pest management information.

MANAGING SECOND PRODUCTION YEAR

About 20% of the strawberry plantings are kept for a two harvest season. These berries are often smaller making pick more expensive. Also the fruit is softer.

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 pounds of nitrogen per month may be needed in some fields.

PRUNING

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.

COST

Cost between growers will vary considerably depending upon how the crop is handled, the mix between summer and winter plantings, market window concerns, and location. This study represents a high input growing system designed at producing a near maximum genetic yield for Pajaro as a summer planting variety. Some costs by cooperating growers used in this study have been left out as it is not certain if these inputs afford a return on investment. Included in these costs are wages for management. Cash flow cost will be somewhat lower than that of this study. These costs reflect accrual cost accounting, fully utilizing depreciation.

STRAWBERRY SAMPLE COST - 10 Acre Production
ESTABLISHMENT COST PER ACRE - Summer Planting
August - December 1990

	<u>Hours Per Acre</u>		<u>Cost Per Acre</u>
	<u>Labor</u>	<u>60 h.p. Tractor</u>	
Plow, disk, subsoil, pre-fertilize	7	7	192.08
Survey for leveling, 4 hrs @ \$25.00/hr			100.00
Leveling and grading 3X	7	7	192.08
Chisel 3X	3	3	82.32
Sprinkle 1X	2		18.12
Plastic removal-fumigation and disposal			40.00
List beds	2		31.08
Sprinkle-preplant 1X	2		24.60
Shape beds and open plant furrows	3		46.62
Transplant and close plant furrows-drip liner	38		370.20
Pest control 1X (sprayer 5.50/hr.)	1		21.04
Irrigate-sprinkle 1X and pipe removal	7		95.82
Replant (5% stand)	6		54.36
Weed and runner cut 3X	64		579.84
Total Cultural Labor and Field Power	142	17	\$1,848.16
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Water 3X			11.15
Fumigation contract			1200.00
Preplant fertilizer (includes soil amendments)			200.00
Plants (plus fungicide) 19,000 @ \$35.00/1000 includes 5% replant			698.25
Fertilizer slow release			320.00
Pest control 1X			51.75
Drip system - 5 year - drip filter pipes - \$100/year + drip line 1800 ft. - 48" bed 18 /ft.			454.00
Rent - 1 crop every 2 years - \$600.00/year			1,200.00
Total Material Cost			\$4,135.15
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Total Cultural Labor, Field Power, and Materials			\$5,983.31
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General Expenses: office, phone, insurance, pickup			800.00
Trucks			272.00
Repairs (shop)			363.40
Total Cash Overhead			\$1,435.00
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TOTAL CASH COST			\$7,418.31
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Interest on Working Capital			640.29
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<u>Investment</u>	<u>Per Acre</u>	<u>Depreciation</u>	<u>Interest 14% on 1/2 Cost</u>
Building	160.00	16.00	11.20
Irrigation-sprinkler	884.00	88.40	61.88
Power equipment	2600.00	260.00	182.00
Total Investment and Interest		364.40	\$ 619.48
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TOTAL COST TO ESTABLISH STAND			\$8,678.08

Labor costs, including fringe benefits and bookkeeping are figured at the following hourly rates: Labor \$9.06; cash costs of fuel, oil, repairs for 60 h.p. diesel crawler \$18.38 per hour; 30 h.p. wheel tractor \$6.48 per hour; and sprayer \$5.50 per hour.

**STRAWBERRY SAMPLE COST PER ACRE
FIRST YEAR MAINTENANCE AND FRUIT HARVEST - Summer Planting**

	Hours Per Acre			Cost Per Acre
	Labor	30 h.p. Tractor	Sprayer	
Weeding	60			543.60
Irrigate 38X and repair drip system	38			344.28
Pest control 10X	10	10	10	210.40
Plastic mulch (burn holes, pull plants through 3X)	24	10		282.24
Miscellaneous	10	2		103.56
Total Cultural Labor and Field Power	142	22	10	\$ 1,484.08
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Plastic				200.00
Pest control 10X				910.00
Water - 3 acre-feet at \$32.00/acre-foot				96.00
Total Material Cost to Harvest				\$ 1,206.00
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Total Labor, Field Power, and Materials				\$ 2,690.08
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General Expenses: office, phone, insurance, pickup				1,400.00
Trucks				284.00
Repairs (shop)				399.80
Total Cash Overhead Costs				\$ 2,083.80
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Subtotal Cultural Cost Except Harvest				\$ 4,773.88
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Interest on Working Capital				385.49
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TOTAL CULTURAL COST EXCEPT HARVEST (includes establishment cost)				\$13,837.45
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Harvest Cost: Pick, supervision, truck driver = 2.18 per tray (estimate). Crates, baskets, wires = .95 Total harvesting tray cost = \$3.13.				

YIELD VS. COST

Trays Per Acre	Cultural Cost Per Tray	Total Cost Per Tray
4000	3.46	6.59
5000	2.77	5.90
6000	2.31	5.44

**STRAWBERRY SAMPLE COST - 10 Acre Production - Processing
SECOND YEAR FRUIT HARVEST
October - July 1990**

	<u>Hours Per Acre</u>			Cost Per Acre
	Labor	30 h.p. Tractor	Sprayer	
Prune and leaf removal	24	2		230.40
Cultivate and repair roads	2	2		31.08
Fertilize 1X	1	1		15.54
Weed and runner cut	34			308.04
Irrigate 25X	26			235.56
Pest control 10X	10	10	10	210.40
Removal old plastic and pipes	9	1		88.02
Disk 2X	2	2		31.08
Total Cultural Labor and Field Power	108	18	10	\$1,150.12
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Fertilizer				268.00
Water 2 acre-feet at \$32.00/acre-foot				64.00
Pest control				700.00
Total Material Cost to Harvest				\$1,032.00
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Total Labor, Field Power, and Materials				\$2,182.12
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General Expenses: office, phone, insurance, pickup				896.00
Trucks				192.00
Repairs (shop)				399.80
Rent - 2 crops every 3 years \$600/year				900.00
Total Cash Overhead Costs				\$2,387.80
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TOTAL CASH COSTS				\$4,569.92
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Interest on Working Capital				364.27
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<u>Investment</u>	<u>Per Acre</u>	<u>Depreciation</u>	<u>Interest 14% on 1/2 Cost</u>	
Buildings	160.00	16.00	11.20	
Irrigation equipment	884.00	88.40	61.88	
Power equipment	2600.00	260.00	182.00	
Total Investment and Interest		364.40	255.08	\$ 619.48
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TOTAL CULTURAL COST - Second Year				\$5,553.67

Harvest Cost, Labor, Supervision, Bookkeeping, Hauling. 18¢/lb includes dockage.

Labor costs, including fringe benefits and bookkeeping are figured at the following hourly rates: Labor \$9.06; cash costs of fuel, oil, repairs for 60 h.p. diesel crawler \$18.38 per hour; 30 h.p. wheel tractor \$6.48 per hour; and sprayer \$5.50 per hour.

YIELD VS. COST	
Pounds Per Acre	Total Cost Per Pound
30,000	.37
40,000	.32
50,000	.29