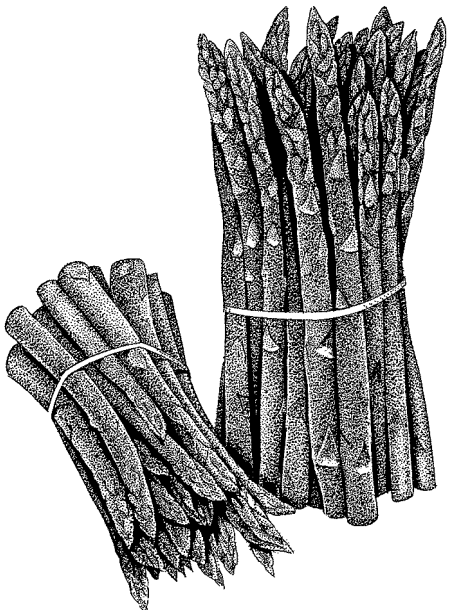
U.C. COOPERATIVE EXTENSION

SAMPLE COST TO ESTABLISH AND PRODUCE

ASPARAGUS



IMPERIAL COUNTY – 2004

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For an explanation of calculations used for the study refer to the attached General Assumptions or call the author, Herman Meister, at the Imperial County Cooperative Extension office, (760)352-9474 or e-mail at hmeister@ucdavis.edu.

FOREWORD

We wish to thank growers, pest control advisors, chemical applicators and chemical dealers, custom farm operators, fertilizer dealers, seed companies, contract harvesters, equipment companies, and the Imperial County Agricultural Commissioner's office for providing us with the data necessary to compile this circular. Without their cooperation we could not have achieved the accuracy needed for evaluating the cost of production for the field crop industry in Imperial County.

The information presented herein allows one to get a "ballpark" idea of field crop production costs and practices in the Imperial County. Most of the information was collected through verbal communications via office visits and personal phone calls. The information does not reflect the exact values or practices of any one grower, but are rather an average of countywide prevailing costs and practices. Exact costs incurred by individual growers depend upon many variables such as weather, land rent, seed, choice of agrichemicals, location, time of planting, etc. No exact comparison with individual grower practice is possible or intended. The budgets do reflect, however, the prevailing industry trends within the region.

Overhead usually includes secretarial and office expenses, general farm supplies, communications, utilities, farm shop, transportation, moving farm equipment, accountants, insurance, safety training, permits, etc. Eleven to 13% of the total of land preparation, growing costs and land rent was used to estimate overhead. Hourly rates vary with each crop depending on the workman's compensation percentages.

Since all of the inputs used to figure production costs are impossible to document in a single page, we have included extra expense in man-hours or overhead to account for such items as pipe setting, motor grader, water truck, shovel work, bird and rodent control, etc. Whenever possible we have given the costs of these operations per hour listed on the cultural operations page. Some custom operators have indicated that they are instituting a "fuel surcharge" to reflect "spikes" in fuel cost.

Not included in these production costs are expenses resulting from management fees, loans, providing supervision, or return on investments. The crop budgets also do not contain expenses encumbered for road and ditch maintenance, and perimeter weed control. If all the above items were taken into account, the budget may need to be increased by 7-15%.

Where applicable we have used terminology that is commonly used in the agricultural industry. These terms are compiled in a glossary at the end of the circular. We feel that an understanding of these terms will be useful to entry-level growers, bankers, students and visitors.

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2004-2005 Tillage & Harvest Rates
IMPERIAL COUNTY

HEAVY TRACTOR WORK & LAND PREPARATION

OPERATION	$/ACRE
Plow	32.00
Subsoil 2nd gear	45.00
Subsoil 3rd gear	38.00
Landplane	14.00
Triplane	12.00
Chisel 15”	26.00
Wil-Rich chisel	17.00
Big Ox	25.00
Slip plow	43.00
Mark/disc borders	10.50
Make cross checks (taps)	6.75
Break border	6.50
Stubble disc/with cultipack	22.50/24.50
Regular disc/with cultipack	13.00/15.00
List 30”-12 row/40” 8 row	16.50
Float	11.50
Dump (scraper) borders	18.25
Corrugate	14.00

LIGHT TRACTOR WORK

Power mulch dry	27.50
Power mulch with herbicide	31.00
Shape 30” 6-row / 40” 4-row	12.75/12.75
Plant sugar beets & cotton 30”/40”	17.00/15.00
Plant vegetables	20.00
Mulch plant wheat	20.25
Plant alfalfa (corrugated)	18.50
Plant alfalfa (beds)	19.00
Plant bermudagrass	13.75
Plant with drill (sudangrass, wheat)	14.75
Plant corn slope	17.00
Cultivate 30”/40” beds 4-row	16.00/14.00
Spike 30”/40” beds 4-row	13.00/11.00
Spike and furrow out 30”/40” 4-row	14.00/12.00
Furrow out 30”/40” beds 4-row	13.00/11.00
Lilliston 30” 6-row / 40” 4-row	14.00/14.00
Lilliston 30” 6 row/ 40” 4-row/ herb	15.50/15.50
Inj fert & fur out 30”/ 40” beds 4-row	16.50/14.50
Fertilize dry & fur out 30”/ 40” 4-row	17.00/15.00
Inject fertilizer flat	15.00
Broadcast dry fertilizer	8.00
Ground spray 30”/40” 8-row	12.00
Chop cotton stalks 30”/40”beds	16.00/14.00
List 80” melon beds	20.00
Plant 80” melon slope beds	22.00
Back fill furrow (melons)	9.5
Cultivate 80” melon slope beds	18.00
Center 80” melon beds	17.00
Re-run 80” melon beds	11.00
Inject fertilizer & furrow out 80” melon beds	18.00
Bust out 80” melon beds	12.00

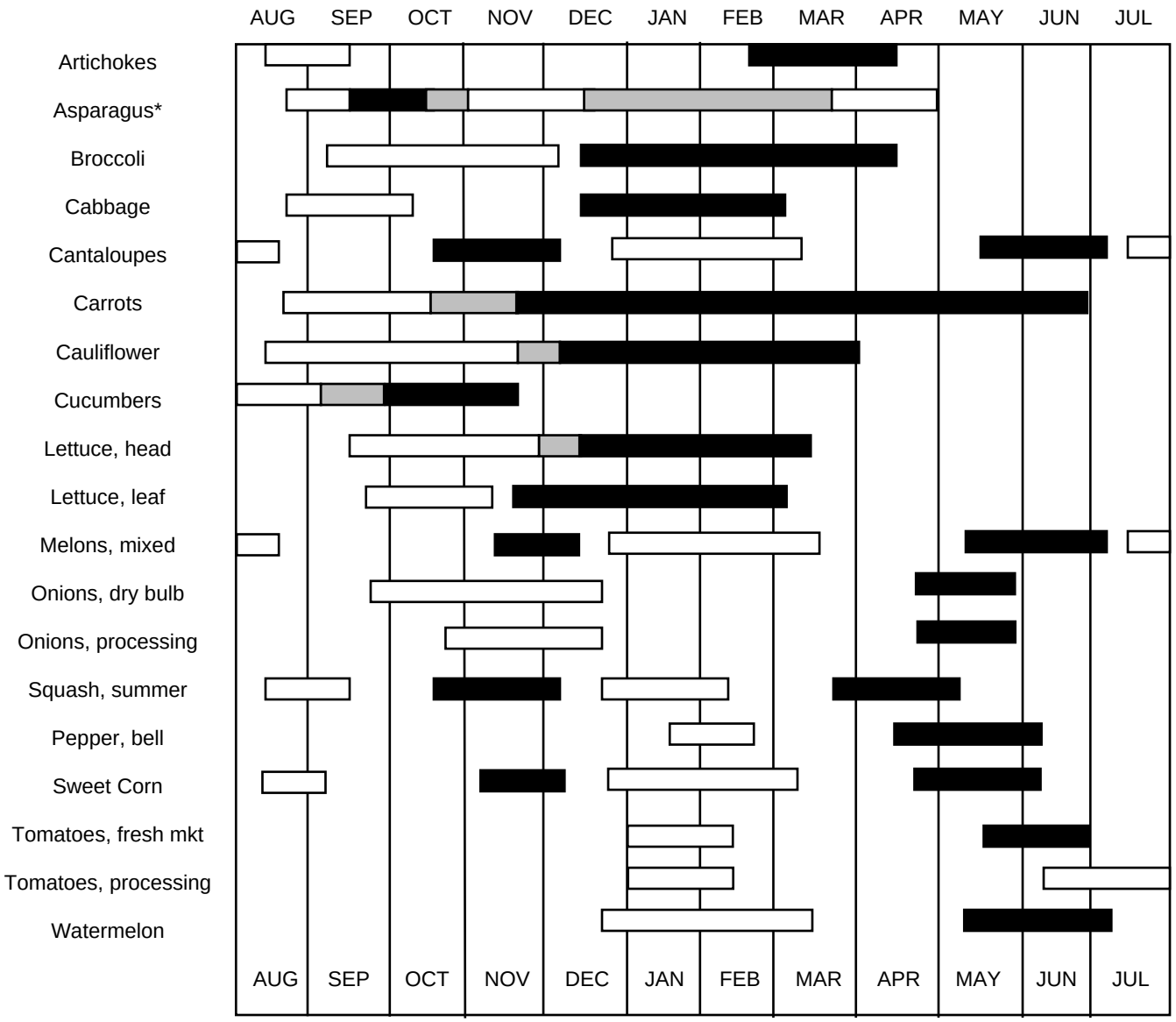
HARVEST COSTS-FIELD CROPS

	BY UNIT
Windrow alfalfa seed	17.50/acre
Combine alfalfa seed	41.00/acre
Swath bermudagrass	13.75/acre
Rake bermudagrass	5.50/acre
Swath sudangrass	11.25/acre
Rake sudangrass	6.00/acre
Swath alfalfa	8.75/acre
Rake alfalfa	5.00/acre
Bale (all types of hay- small bale)	0.70/bale
Haul & stack hay – small bale	0.27/bale
Bale (large bale 4X4)	7.50/bale
Haul & stack big bale	3.50/bale
Load with hay squeeze	62.50 / load
Dig sugar beets	2.65/clean ton
Haul sugar beets	2.50/clean ton
Combine wheat	16.00 per acre + 0.60 /cwt. over 1 ton
Haul wheat	5.00/ton
Combine bermudagrass seed 1st time	42.50/acre
Combine bermudagrass seed 2nd time	26.50/acre
Haul bermudagrass seed (local)	175/load
Pick Cotton 1st/2nd	03cts/lb/35.00/acre

MISCELLANEOUS RATES BY THE HOUR

	$/HR
Motor grader	55.00
Backhoe	50.00
Water truck	40.00
Wheel tractor	35.00
Scraper	36.00
Versatile	60.00
D-6	56.00
D-8	73.00
Buck ends of field	35.00
Pipe setting (2 men)	38.00
Laser level	90.00
Work ends (disc out rotobucks)	40.00

VEGETABLE CROPS
PLANTING & HARVESTING CALENDAR
IMPERIAL VALLEY, CALIFORNIA



MONTH

planting

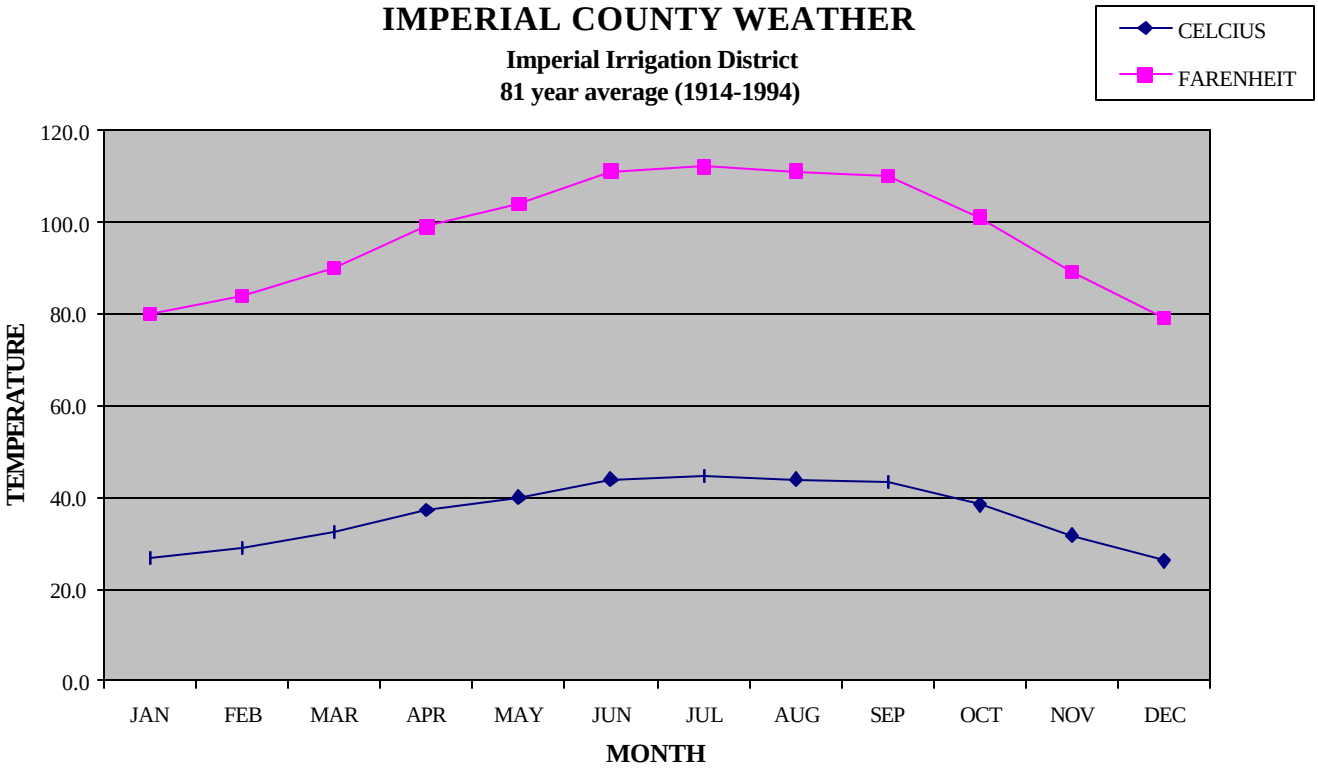
planting/harvesting

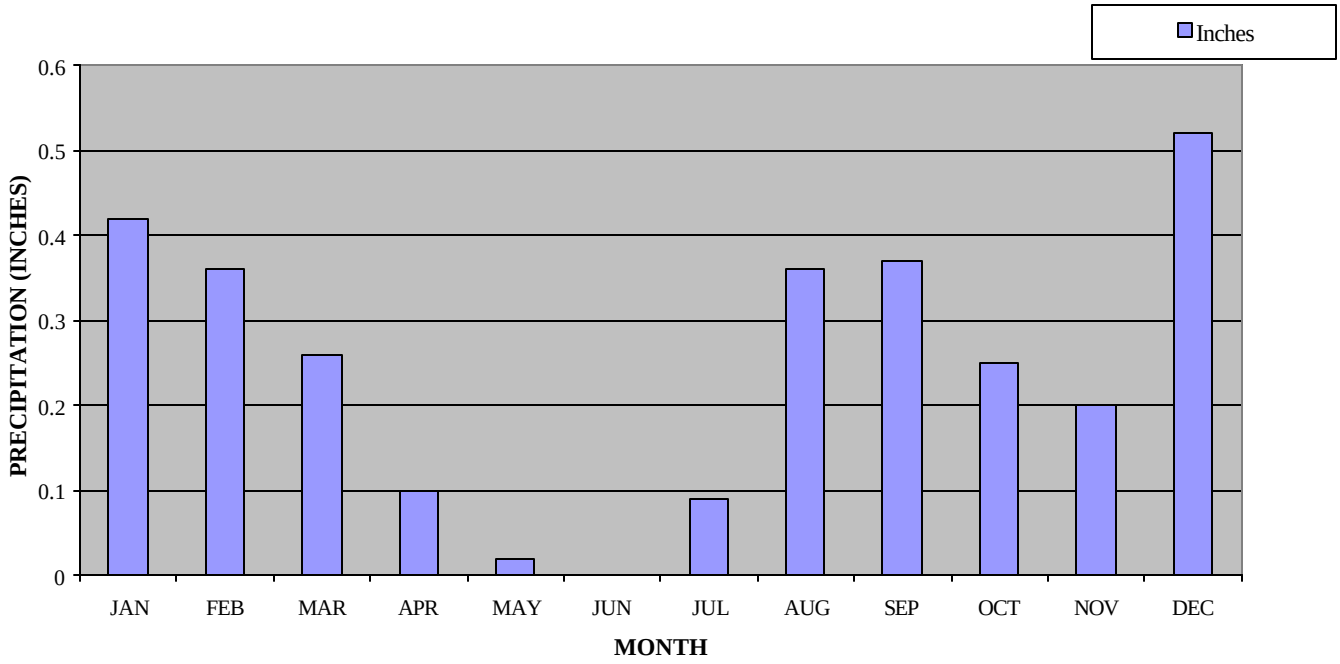
harvesting

* perennial

IMPERIAL COUNTY WEATHER

Imperial Irrigation District
81 year average (1914-1994)





DAYS REQUIRED FOR SEEDLING EMERGENCE* AT VARIOUS SOIL TEMPERATURES

Soil Temperature (°F)

Vegetable	32	41	50	59	68	77	86	95	104
Asparagus	NG	NG	53	24	15	10	12	20	28
Beet	/	42	17	10	6	5	5	5	/
Cabbage	/	/	15	9	6	5	4	/	/
Cantaloupe	/	/	/	/	8	4	3	/	/
Carrot	NG	51	17	10	7	6	6	9	NG
Cauliflower	/	/	20	10	6	5	5	/	/
Celery	NG	41	16	12	7	NG	NG	NG	/
Cucumbers	NG	NG	NG	13	6	4	3	3	/
Eggplant	/	/	/	/	13	8	5	/	/
Lettuce	49	15	7	4	3	2	3	NG	NG
Okra	NG	NG	NG	27	17	13	7	6	7
Onion	136	31	13	7	5	4	4	13	NG
Parsley	/	/	29	17	14	13	12	/	/
Parsnip	172	57	27	19	14	15	32	NG	NG
Peppers	NG	NG	NG	25	13	8	8	9	NG
Radish	NG	29	11	6	4	4	3	/	/
Spinach	63	23	12	7	6	5	6	NG	NG
Sweet Corn	NG	NG	22	12	7	4	4	3	NG
Tomato	NG	NG	43	14	8	6	6	9	NG
Watermelon	/	NG	/	/	12	5	4	3	/

*planting depth = 0.5 inches; NG = no germination; / = not tested; Source: Harrington, J. F. and P. A. Minges, Vegetable Seed Germination. California Agricultural Extension Mimeo Leaflet (1954).

SEED CALCULATIONS (M)

Number of seed (x1000) required[1] per acre for common plant spacing combinations within rows and between beds. Commonly coded as "M" or 1000 seed

	Spacing between beds[3] (inches)					
Plant spacing within rows[2] (inches)	**30**	**40**	**42**	**60**	**66**	**80**
1	209.1	156.8	149.4	104.5	95.0	78.4
1.5	139.4	104.5	99.6	69.7	63.4	52.3
2	104.5	78.4	74.7	52.3	47.5	39.2
2.5	83.6	62.7	59.7	41.8	38.0	31.4
3	69.7	52.3	49.8	34.8	31.7	26.1
4	52.3	39.2	37.3	26.1	23.8	19.6
6	34.8	26.1	24.9	17.4	15.8	13.1
8	26.1	19.6	18.7	13.1	11.9	9.8
10	20.9	15.7	14.9	10.5	9.5	7.8
12	17.4	13.1	12.4	8.7	7.9	6.5
14	14.9	11.2	10.7	7.5	6.8	5.6
24	8.7	6.5	6.2	4.4	4.0	3.3
36	5.8	4.4	4.1	2.9	2.6	2.2

[1] Seeds per acre was calculated assuming one seed per spacing combination. Factors influencing the actual amount of seed needed are seed delivery method and seed viability; [2] Values are based on beds with a single row. For multiple rows, multiply by the number of rows per bed; [3] Beds are measured from center to center.

Linear feet per acre for common bed widths

Bed width (inches)	Linear feet per acre
30	17,424
40	13,068
42	12,446
60	8,712
66	7,920
80	6,534

IMPERIAL COUNTY ASPARAGUS PROJECTED PRODUCTION COST 2004-2005

40 Acre Field

Hand labor at $9.95 per hour ($6.75/hr plus SS, unemployment insurance, workman's compensation, and fringe benefits).

Yield--150-30-lb. pyramid cartons (4,500 lbs/ac.) 8-10 year crop life

OPERATION	Cost	Materials		Hand Labor		Cost
		Type	Cost	Hours	Dollars	Per Acre
LAND PREPARATION						
Stubble disc / ring roller	24.50					24.50
Subsoil 2nd gear	45.00					45.00
Disc 2x	13.00					26.00
Triplane	12.00					12.00
Border,cross check & break borders	23.75					23.75
Flood irrigate		Water 1 ac/ft	16.00	1	9.95	25.95
Disc 2x	13.00					26.00
Triplane	12.00					12.00
Laser level	50.00					50.00
Fertilizer, spread	8.00	500 lb. 11-52-0	75.00			83.00
List	16.50					16.50
Shape beds	10.00					10.00
TOTAL LAND PREPARATION						**354.70**
GROWING PERIOD						
Plant	22.50	Direct seed	100.00			100.00
Sprinkle irrigation	185.00					185.00
Move beds 3X	15.00					45.00
Weed Control	12.50	Herbicide	40.00			52.50
Cultivate 2x	15.00					30.00
Spike 2x	11.00					22.00
Fertilize & furrow out 2x	15.00	200 lb. N as UAN32	76.00			106.00
Lilliston 1x	14.00					14.00
Irrigate 10x		4 ac/ft	64.00	3	29.85	93.85
Insect control 4x	6.50	Insecticides	45.00			84.00
TOTAL GROWING PERIOD COSTS (FIRST YEAR)						**732.35**
GROWING PERIOD & LAND PREPARATION COSTS (FIRST YEAR)						**1,087.05**
Land Rent (net acres)						250.00
Cash Overhead----	15 % of preharvest costs & land rent					200.56
TOTAL FIRST YEAR COSTS						**1,537.61**
STAND MAINTENANCE (8-10 YEAR LIFE)						
Chop or swath fern 1x	25.00					25.00
Burn fern	3.00					3.00
Flail scalp	13.00					13.00
Rotovate-shape beds 1x	27.00					27.00
Spike 1x	11.00					11.00
Cultivate 2x	15.00					30.00
Fertilize and furrow out 2x	15.00	300 lb. N as UAN 32	114.00			144.00
Water-run fertilizer		200 lb. N as UAN 32	76.00			76.00
Weed control 2x	12.50	Herbicide	45.00			70.00
Irrigate 18x		6.5 ac/ft	105.60	6	59.70	165.30
Disease control 2x	11.50	Fungicides	30.00			53.00
Insect control 6x(3 early, 3 late)	10.00	Insecticide	90.00			150.00
TOTAL ANNUAL COSTS						**767.30**
GROWING PERIOD COSTS						
Land Rent						250.00
Overhead	14 % land rent and preharvest costs					142.42
Amortization	14 % of first year costs (excluding land rent & overhead)					152.19
TOTAL PREHARVEST COSTS						**1,311.91**
HARVEST COSTS						
Cut, haul, pack, cool, and sell	150 -30 lb. cartons @	28.50	per carton			4,275.00
TOTAL OF ALL COSTS						**5,586.91**

PROJECTED PROFIT OR LOSS PER ACRE

Price/ 30-lb. carton (dollars)

		28.00	30.00	32.00	34.00	36.00	Break-even $/carton
	100	-1362	-1162	-962	-762	-561.91	41.62
Cartons	**125**	-1374	-1124	-874	-624	-374.41	39.00
per	**150**	-1387	-1087	-787	-487	-186.91	37.25
acre	**175**	-1399	-1049	-699	-349	0.59	36.00
	200	-1412	-1012	-612	-212	188.09	35.06

*Harvest cost varies with the field conditions, the shipper and the market value.

IMPERIAL COUNTY ASPARAGUS CULTURE 2004-2005

Annual acreage, yield, and value of asparagus
in Imperial County, CA (1999-2003)

Year	Acres	Yield/Acre*	Value/Acre
2003	2,522	140	$3,979
2002	3,429	139	$4,312
2001	4,557	174	$4,881
2000	5,575	109	$2,872
1999	5,006	141	$3,991

* 30 lb carton equivalent;
(Source: I.C. Agricultural Commissioner's Reports 1999-2003)

PLANTING-HARVESTING DATES: Asparagus is a perennial crop. Once established the crop may be harvested in the early fall if market conditions warrant, or harvested in late winter and early spring. The harvest continues until the price starts to fall or the crop looses quality due to opening of the tips and toughening of the spears.

VARIETIES: The main varieties grown are UC Hybrid 157_{F1} (various), Ida Lea (various) and Brock Imperial (Brock). Grande, Apollo, and Atlas are from California Asparagus Seed and Transplants, Inc.

PLANTING INFORMATION: Asparagus may be established by transplanting and direct seeding. Transplants can be planted anytime during the year, but October through March is recommended. Bed width varies from 40-60 inches depending upon grower preference. Plant spacing is usually 6-inches in-row. There is normally one row per 60-inch bed for a population of roughly 8,500 plants per acre.

Due to lower asparagus returns in recent years many fields have been installed at the least possible cost. Currently, most new fields are direct seeded as labor costs have precluded the use of transplants.

SOILS: Well-drained sandy loams and loams are best for asparagus production. The warmer the soil, the earlier the production will be. For this reason, some fields are located in the warmer zones of the valley. Careful attention should be given to field selection because the land will be tied up in asparagus production for 8-10 years. Fields that are known to have bermudagrass or nutsedge problems are poor choices for asparagus production because of weed competition and the increased cost of chemical control.

IRRIGATION: Fifteen or more irrigations per year are not unusual. The irrigation interval during the summer is from 10 to 15 days. Because the harvesting period lasts 30-60 days, it is necessary to continue irrigation during harvesting. This makes both timing and method of water application very important.

Frequent irrigation of alternate rows during harvesting maintains even production while allowing harvesting crews entrance to fields. Crews are encouraged to walk in dry furrows rather than on bed tops where they might damage emerging spears.

FERTILIZERS: Between 100-200 pounds of phosphate and 200-400 pounds of actual nitrogen are used on most plantings. All of the phosphate and at least one-third of the nitrogen are applied in winter before the cutting season. The remaining nitrogen is applied during and after the harvest season.

PEST CONTROL: Weeds can become a serious problem in established asparagus. A pre-emergence herbicide should be applied after the fern is chopped and burned, but before harvest. During the harvesting period, spot treatments with an herbicide may be necessary. Herbicide applications after cutting and before fern regrowth are common. Avoid planting in fields that have bermudagrass or nutsedge infestations.

Western yellow striped armyworm, beet armyworm, and bean thrips are the most important pests requiring several insecticide treatments annually. The European asparagus aphid is a serious pest requiring several additional insecticide treatments. Asparagus miner may periodically need to be controlled.

Asparagus rust (*Puccinia asparagi*) and Cercospora stem and leafspot (*Cercospora asparagi*) may require control in some years, especially on new plantings. Asparagus root rot (*Fusarium oxysporum* and *F. moniliforme*) are problems present during the mid-to late-years of stand life.

Asparagus crown and spear rot (*Phytophora megasperma* var. *sojae*) occur in soils with poor drainage and those with excessive irrigation. Asparagus purple spot (*Stemphylium vesicarium*) may occur during cool, wet weather at harvest.

HARVESTING: Mature 5-foot-tall ferns are either chopped or windrowed with a swather. After drying, ferns are usually burned. Fern chopping occurs from late November to early December. Following chopping, the planting beds are reworked to loosen the surface soil, re-shaped, fertilized, and irrigated prior to the first harvest which usually occurs mid-to late-January.

Irrigation is scheduled so that alternate furrows remain dry. This allows continuous field access for harvesting crews. Workers must avoid stepping on the tips of emerging spears because this mechanical damage will cause distortion as the spear elongates, making it unmarketable. Some asparagus is being grown successfully on drip irrigation as an alternative to furrow irrigation.

Newly emerging spears are hand-cut from mid-January through mid-April at 1 to 3 day intervals depending upon temperature and growth rate. Early in the season, fields are harvested every two or three days, but during warm weather fields are cut daily. Spears are cut at an angle and just below the soil surface with an asparagus knife. Spindly or otherwise deformed spears are cut and discarded to allow for growth of

marketable spears. Cut spears must be approximately 10 inches long to allow for a trim to 9 inches during packing. Harvested spears are placed on the beds in bunches, gathered and placed in field boxes, carried out of the field on makeshift wheel barrows, and hauled to sheds for grading, trimming, packing, and cooling.

Asparagus is packed in various containers including: 30-pound loose, 28 bunches per crate (28-lb. net wt), and 11 bunches per crate (11 lb. net wt). Sizes for these packs are Large (7/16"), Standard (5/16"), and Small (3/16"). Diameter is measured at the widest point of the spear.

Another commonly used container holds six 2.25 lb. bunches (net weight 13.5 lb.) often used for international shipment. Sizes for this pack include Colossal (no more than 14 spears per bunch), Jumbo (15-20 spears), Large (21-28 spears), and Standard (29-42 spears).

Some of the product is packed out in 30-pound wood crates chiefly for Japanese export. There are also 27-pound cartons (12- 2.25 lb. bunches) for domestic and export, 15-pound cartons of asparagus tips for domestic use, and some 15-pound cartons packed loose for export mostly to Europe. Some asparagus may be trimmed to 5½-7 inches in length and packed as tips in 15-pound cartons.

Defects and loss of production can occur for various reasons. Wind will cause spears to curve because they can grow 3-6 inches per day depending on temperature. Trampling of emerging spears, inadvertent cutting of spears during harvest, or high temperatures will cause misshapen spears. High temperatures will also cause flowering or premature break of the bracts, especially in small spears. This condition is commonly referred to as "feathering" because of the featherlike appearance of flowering spears. Flattened spears ("flats") are the result of certain varietal characteristics. Thrips feeding can cause significant reduction in the cosmetic appeal of spears.

Freezing temperatures during spear emergence can cause "frosting" or discoloration of green spears. Frosted spears may still be marketable, however, at a reduced value. If spears are cut while still frozen, damage is usually too severe to yield a marketable product. Sometimes ice formation is difficult to see because the ice is clear. This condition is known as "black ice." A field with black ice will appear darker green overall than what is normally observed.

Excessive harvesting will lead to a decline in production and a proliferation of small spears. During the third year, harvesting may be continued the full season (i.e. about 60 days).

Fields in their second year of production may be harvested, but the harvesting period should be limited to 2-4 weeks and should only be done in the most vigorous plantings. Asparagus fields should give good yields for 8-10 years. Asparagus is capable of a much longer production life, but it is

usually limited in later years by weed infestations and *Fusarium* infections. A common rotation crop used after asparagus is wheat because it will do well despite weed infestations and *Fusarium*.

POSTHARVEST HANDLING: Asparagus is an extremely perishable product. It must be cooled quickly after harvest. Local packing sheds hydrocool spears to remove the field heat after packing. Cooled water (approximately 38°F) is drenched over the packed cartons for approximately 15 minutes. Asparagus needs to be stored at 32-36°F with ≥95% relative humidity.

At high temperatures, asparagus spears will lose natural sugar, flavor, vitamin C, and become tough, and start to decay. If rapidly cooled and held at 36°F, asparagus may be kept for about 3 weeks. Desiccation can occur rapidly if asparagus spears are not placed on wet pads, since spears continue to elongate after harvest.

Bacterial soft rot will occur at either the spear tips or butts if they are not quickly brought to optimum storage temperature and humidity.

Storing asparagus in non-ventilated containers will result in spear toughening.

For more information see "Asparagus Production in California", UC Publication 7234 available from our office or on the Internet at http://anrcatalog.ucdavis.edu/specials.ihtml .

----------NOTES----------

GLOSSARY

Air spray The application of chemicals by aircraft.
Back fill furrows To shave soil off the top of melon beds and place it into a furrow in order to bring the irrigation water closer to the melon seedline.
Bed Mounded soil that is shaped and used for planting; beds are separated by furrows.
Bell Bell pepper.
Big Ox A chisel with 7 shanks used to rip soil 18-24 inches deep.
Blacken the beds To wet/darken a bed with irrigation water.
Black Ice Ice formation on asparagus that is clear and therefore difficult to detect.
Blanks Lack of individual kernel formation in corn.
Brassicas Plants belonging to the genus *Brassica*, of the mustard family (Cruciferae), including cabbage, kale, broccoli, cauliflower, turnip, and mustard; all brassicas are crucifers, but not all crucifers are brassicas.
Break a field To harvest a crop the first time in a season.
Break borders To tear down flat flood borders or flat crop borders.
Breaker A tomato fruit that is beginning to show color change from green to pink on the blossom end; preceded by the *mature green* stage.
Brix A measure of sugar content, especially in tomatoes; a graduated scale, used on a hydrometer, that indicates the weight of sugar per volume of solution.
Brown bead A physiological disorder of broccoli thought to be related to lack of calcium uptake and excessive heat during head formation.
Buck ends of field The remaking of beds at the end of a field in order to channel irrigation water properly; a necessary practice when beds at the end of a field are destroyed due to insufficient turn around space for farm equipment.
Cateye A condition in broccoli where some beads begin breaking into yellow flower; also called *starring.*
Cello Poly bags which hold one or two pounds of carrots; from "cellophane".
Chisel A tractor-mounted, knife-like implement used to rip soil about 20 inches deep.
'choke Artichoke
Cole crops Any of various plants of the genus *Brassica*, of the mustard family.
Cos Romaine Lettuce
Cross checks Small dikes at perpendicular angles to borders used for water diversion into a field.
Crucifers Plants belonging to the Cruciferae or mustard family (e.g., broccoli, brussel sprouts, cabbage, cauliflower, etc.).
Cucurbits Plants belonging to the melon or gourd family (e.g., cantaloupe, watermelon, pumpkin, cucumbers, squash, etc.).
Cull To separate unwanted product from desirable product.
Cultipacker A farm implement used to break up clods of soil; consists of groups of knobbed metal rings stacked together.
Cultivate To work beds after planting in order to control weeds, loosen soil, and allow for application of fertilizer.
Curd The edible portion of marketed cauliflower.
Custom rate The value assigned to a cultural operation by farmers for cost accounting; normally includes the cost of the operator.
Damping-off A fungal disease of seedlings that causes rotting of the stem at the soil level and collapse of the plant.
Doubles The placement of two seeds rather than one when one is intended.
Drift Agrichemicals, dust or pests, which inadvertently fall on nearby (usually adjacent) non-target crops; usually the result of spraying products (especially products of small particle size) on windy days or of poor equipment operation.
Drip Irrigation The slow application of low pressure water in tubes or pipes (buried or on the surface): sometimes called trickle irrigation.
Edema (oedema) A physiological disorder of plant resulting from over-watering; numerous small bumps on the lower side of leaves or on stems divide, expand, and break out of the normal leaf surface and at first form greenish-white swellings or galls; the exposed surface

later becomes rusty colored and has a corky texture; especially common in cabbage.
Excelsior Fine wood shavings; used for stuffing, packing, etc.
Feathering Premature flowering of asparagus due to high temperatures.
Flats Flattened asparagus spears caused by certain varietal characteristics.
Float A large, wooden frame pulled with a tractor for rough leveling of the soil surface.
Flood irrigation A method of irrigation where water is applied to a field by gravity; the water is applied to a field by gravity; the water is channeled by earth borders that are usually 70 feet apart.
'flower Cauliflower
Forking The division of a tap root (especially carrots and lettuce) into branches; can be caused by nematode feeding, soil-borne pathogens, and soil texture.
Frost kissed Produce that has been frozen in the field and has a frosty appearance.
Furrow irrigation A method of irrigation where water is applied to fields by gravity flow down furrows; the water enters the bed by capillary action.
Furrow out The removal of soil from furrows by tractor-mounted shovels.
Gated pipe Large diameter pipes used to deliver low pressure water to each furrow; used to keep head end of field dry for cultivation or harvesting.
Green line A term used to describe the appearance of an emerging row crop as plants germinate and emerge above the soil line, a *green line* appears; often growers switch from sprinkler to furrow irrigation when a field can be *green-lined.*
Ground spray The application of an agrichemical by a tractor-mounted sprayer.
Hollow stem A physiological disorder in broccoli resulting from excessive plant spacing.
Honeydew Sweet excrement from aphids and whiteflies as a result of feeding on plant sap. Honeydew attracts ants and will support the growth of fungi (sooty mold).
Hydrocool To cool produce using ice cold water.
Inject fertilizer The application of liquid fertilizer in the top or sides of a bed.
Jelly Gelatinous material present in *mature-green* tomatoes (see also *locule*).
Landplane A large, tractor-pulled, land leveling machine.
Laser level A land surface leveler that uses a laser guiding device to maintain an accurate grade.
Layby To apply an herbicide or other agrichemical at the last opportunity to enter a field with a tractor prior to harvest.
Lilliston A rolling cultivator with curved tines which uses ground speed to assist in working up the soil surface in order to destroy weeds.
Listing Throwing soil in to a mound to make beds.
Locules Tomato fruit seed cavity.
Mature-green A stage of tomato fruit development when the fruit is fully grown and shows brownish ring at the stem scar after removal of the calyx; color at the blossom end has changed from light green to yellow-green and the seeds are surrounded by *jelly*.
Motor grader A large grader normally used to cut tail ditches for draining off excess surface water.
Naked pack Head lettuce packed without a wrapper.
Pegging the emergence of a *radicle* from seed and its placement in the soil.
Pipe setting Installing 2-inch plastic tubes through a soil berm with a hydraulic ram; the pipes are used to control the flow or irrigation water.
Power mulch A tractor-mounted, power rototiller.
Precision planter Planters which drop seeds at exact intervals; may function mechanically or by vacuum.
Primed seed Lettuce seed that has been *primed* for germination by soaking in *osmotic* solutions (e.g., polyethylene glycol [PEG]) as a preventative to *thermodormancy.*
Pull borders To make flood berms used to channel the water.
Punching pipe see *pipe setting.*
Putting the crop to sleep A phrase used to describe the over-watering of tomatoes by furrow irrigation following sprinkler irrigation; encourages shallow rooting and decreased plant growth.
Radicle The embryonic root.

Random flow planter A non-precision planter; seed drop is regulated by agitating the seed in a hopper over a hole; planting rate depends upon hole size and tractor speed.
Ricing Undesirable granulation of floret tips in cauliflower.
Roll beds A large, metal roller used to firm beds prior to thinning.
Rototill To mechanically mix soil.
Row A line of plants or a bed with a single line of plants.
Seedline A line down a bed in which seeds are planted.
Sidedress To place agrichemicals in a band next to a row of plants.
Silking Period of corn ear formation when silky threads emerge from the ear tip.
Slant bed A culturing technique where beds are slanted towards the winter sun (35-37 degrees from horizontal) such that the bed is perpendicular to the sun's rays.
Slip plow An implement pulled by a caterpillar and used to make deep cuts into the soil whereby soil from below is carried upward into the cut; used to improve drainage.
Slush-ice-cooling A cooling method used on broccoli; a mixture of water and ice is forced rapidly into cartons to cool the product.
Spike The running of tractor-mounted shanks into the soil or beds to improve aeration and drainage.
Sprinkler irrigate The application of irrigation water by pressurized injection into the air.
Starring see *cateye*
Stinger A root emerging from seed; a *radicle*
Stubble disc An implement used to chop crop residue and incorporate it into the soil; the blades are scalloped and operate like a pizza cutter.
Subbing Irrigation method where water is applied to a field in furrows and allowed to travel across beds by capillary action.
Subsoil The pulling of large, hard-faced shanks through the soil up to 42 inches deep; used to shatter soil layers and improve drainage.
Swamper Watermelon harvesting crew member.
Swath To cut a tall crop such as asparagus fern.
Taps See *cross checks*
Tasseling The emergence of corn inflorescence.
Thermodormancy A condition of lettuce seed where high temperatures (>86°F) make seed go dormant, thus inhibiting germination.
Thin The removal of excess crop plants and weeds in the seedline in order to achieve desired plant spacing.
Tillering Emergence of multiple stalks from the same root in corn.
Tip burn A condition, especially in lettuce, where leaf tips are burned; thought to be due to lack of calcium uptake; foliar applications of calcium do not correct the problem.
Trio A head lettuce having crew unit consisting of two cutters and a packer; only used in *naked pack* lettuce.
Triplane A smaller, three-wheeled version of a *landplane.*
Triwall cardboard Triple-layered, corrugated cardboard used to make very sturdy fiberboard containers for watermelon.
Vacuum cooling A cooling method whereby commodities are placed in a strong-walled room, air pressure is reduced and heat consumed in the process cools the product.
Versatile A large caterpillar-sized tractor with rubber tread; used to pull discs and other implements; safe for crossing asphalt roads.
Water run An application of an agrichemical in irrigation water (i.e., furrow irrigation).
White star White markings at the blossom end of tomatoes that turn from green to white as the fruit matures; an indicator of maturity in tomatoes.
Wil-rich chisel plow An implement used to work wet or moist soils prior to making beds.
Wind whip Girdling of seedling stems due to high winds. Seedlings are especially susceptible following thinning or weeding; cole crops are most susceptible.