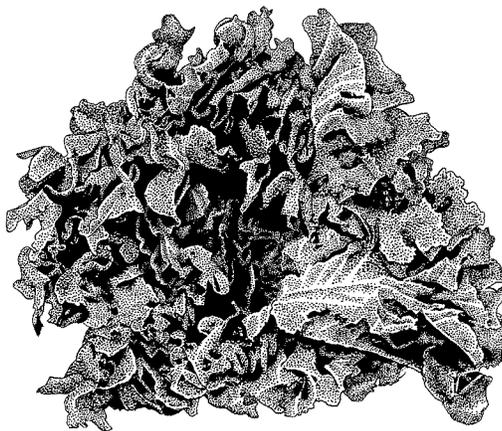


**U.C. COOPERATIVE EXTENSION**

**SAMPLE COST TO ESTABLISH AND PRODUCE**

***LEAF LETTUCE***



**IMPERIAL COUNTY – 2004**

**Prepared by:**

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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](mailto:hmeister@ucdavis.edu).

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University of California and the United States Department of Agriculture cooperating.

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## 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**

<u>OPERATION</u>	<u>\$/ACRE</u>
Plow.....	32.00
Subsoil 2 <sup>nd</sup> gear.....	45.00
Subsoil 3 <sup>rd</sup> 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**

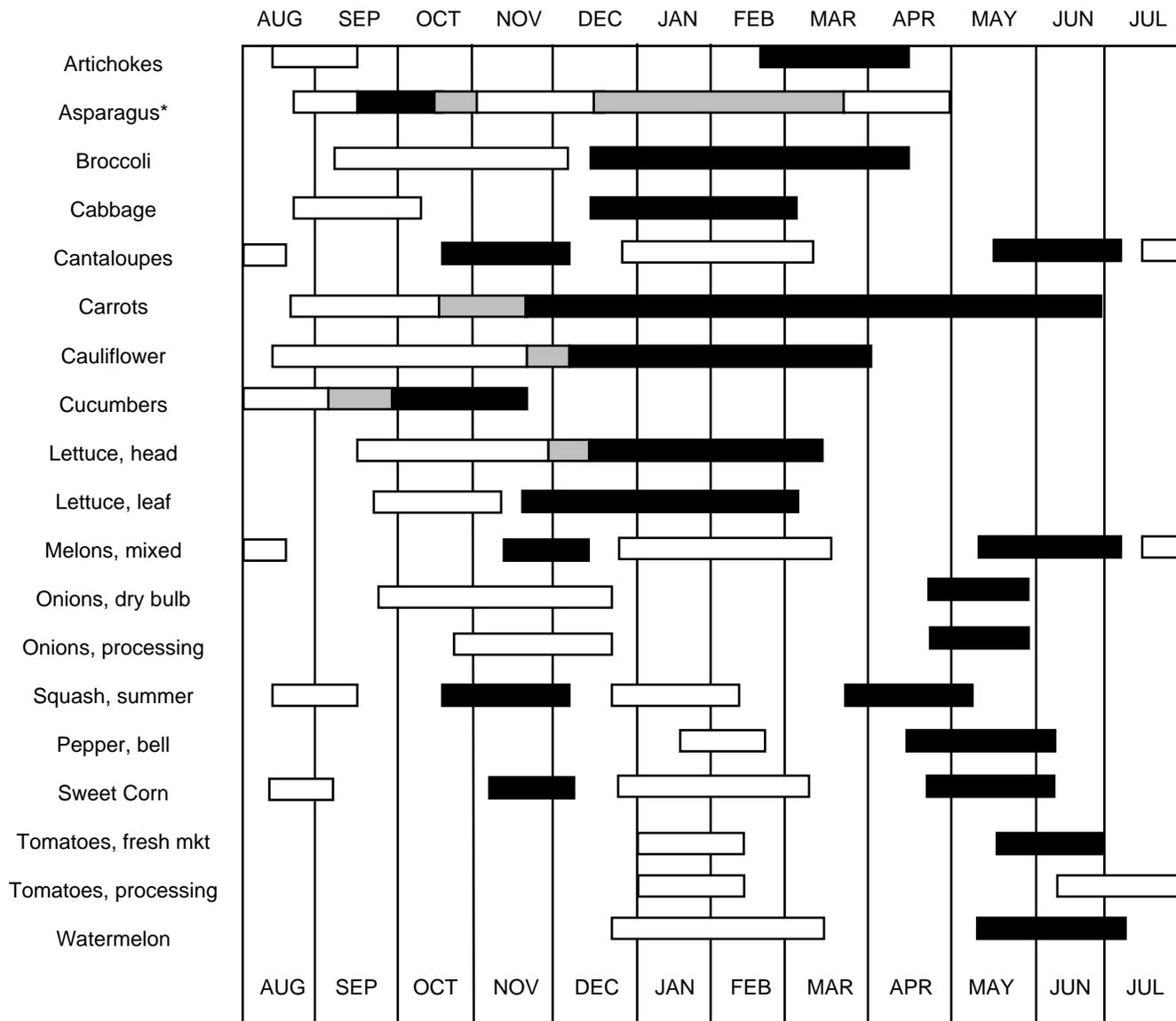
Windrow alfalfa seed.....	17.50/acre
Combine alfalfa seed.....	41.00/acre
Swath bermudagrass.....	13.75/acre
Rake bermudagrass.....	5.50/acre
Swath sudangrass.....	11.25/acre
Rake sudangrass.....	6.00/acre
Swath alfalfa.....	8.75/acre
Rake alfalfa.....	5.00/acre
Bale (all types of hay- small bale).....	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 1 <sup>st</sup> /2 <sup>nd</sup> .....	.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

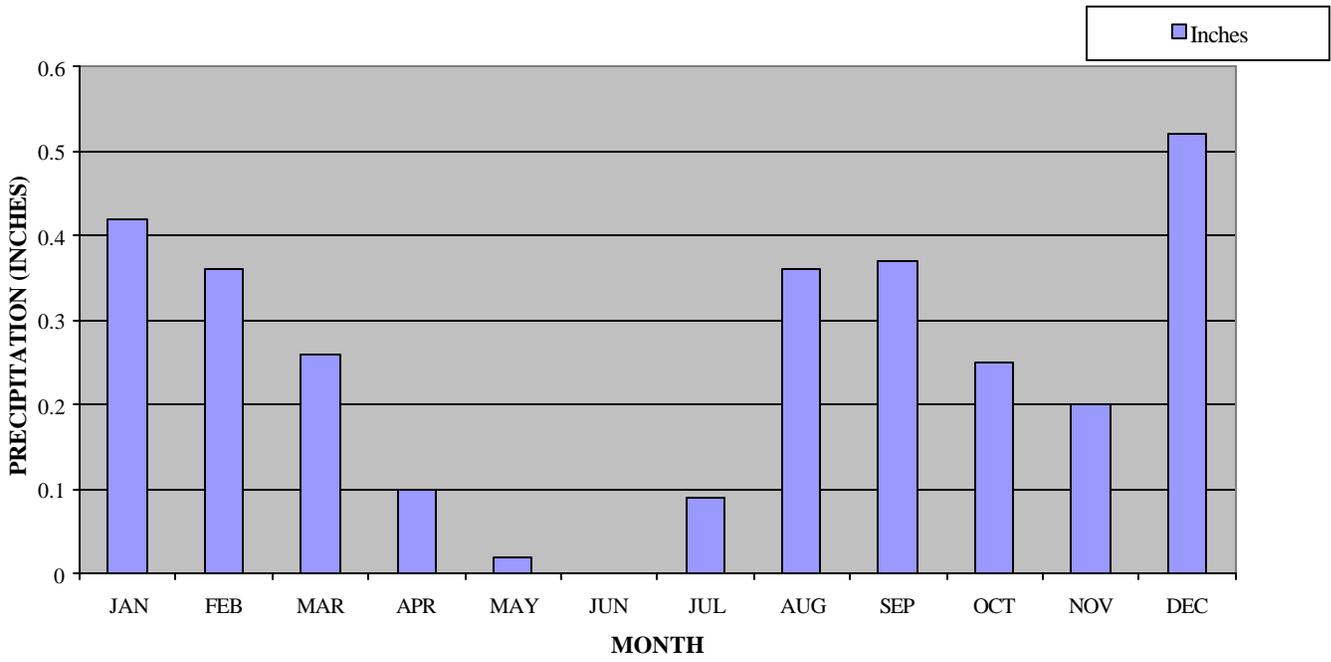
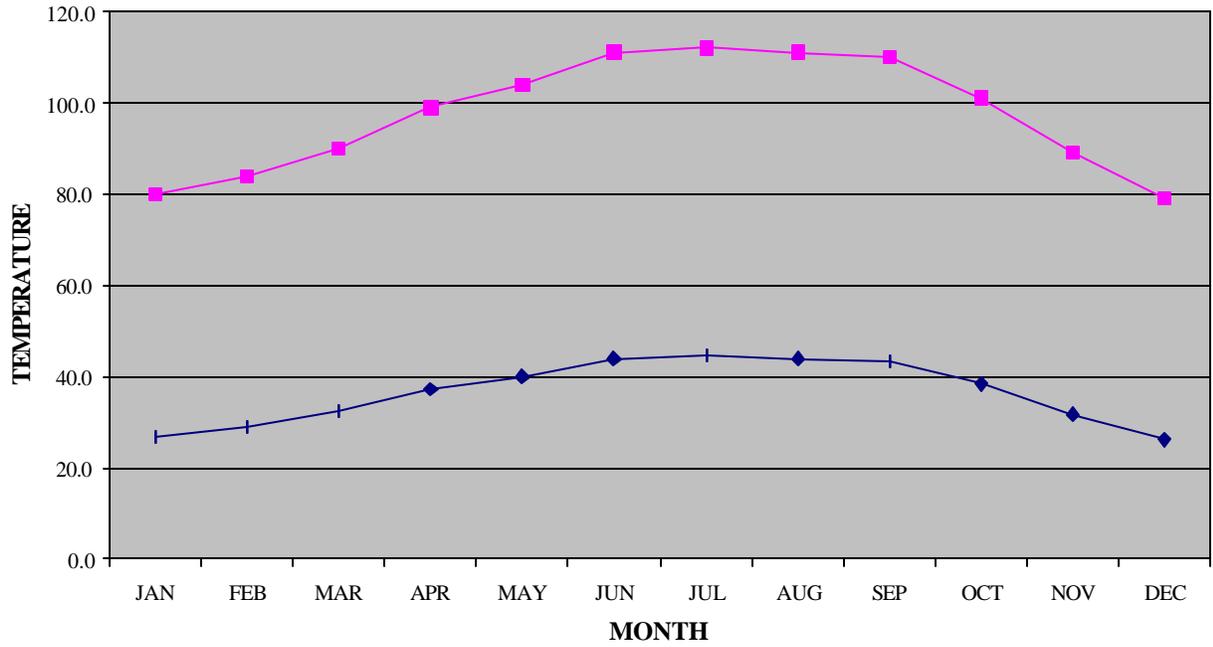
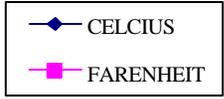


**MONTH**

- 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**

Vegetable	Soil Temperature (°F)								
	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<sup>1</sup> per acre for common plant spacing combinations within rows and between beds. Commonly coded as “M” or 1000 seed

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

<sup>1</sup> 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; <sup>2</sup> Values are based on beds with a single row. For multiple rows, multiply by the number of rows per bed; <sup>3</sup> 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 LEAF LETTUCE PROJECTED PRODUCTION COSTS 2004-2005**

**40 Acre Field**

Hand labor at \$9.95 per hour (\$6.75 plus SS, unemployment insurance, workman's compensation and fringe benefits).  
 Yield--900 35-pound cartons per acre 90-120 days to maturity **Romaine**

OPERATION	Cost	Materials		Hand Labor		Cost Per acre
		Type	Cost	Hours	Dollars	
<b>LAND PREPARATION</b>						
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
Fertilizer, spread	8.00	500# 11-52-0	75.00			83.00
List 40/42" beds	16.50					16.50
<b>TOTAL LAND PREPARATION</b>						<b>294.70</b>
<b>GROWING PERIOD</b>						
Power mulch beds	27.50					27.50
Precision plant and inject insecticide	22.50	Coated seed 157M Admire	160.00 60.00			182.50 60.00
Weed control / chemigation		Herbicide	35.00			35.00
Sprinkler irrigate	165.00					165.00
Thin				15	149.25	149.25
Cultivate 1x	14.00					14.00
Spike 2x	11.00					22.00
Fertilize & furrow out 2x	14.50	120 lb. N / UAN 32	45.60			74.60
Water-run fertilizer		100 lb. N / UAN 32	38.00			38.00
Hand weed 2x				10	99.50	99.50
Irrigate 6x		Water 3 ac/ft	48.00	4	39.80	87.80
Gated pipe irrigation	50.00					50.00
Insect control 7x	10.00	Insecticides	170.00			240.00
Disease control 1x	11.50	Fungicide	10.00			21.50
<b>TOTAL GROWING PERIOD</b>						<b>1,266.65</b>
<b>GROWING PERIOD &amp; LAND PREPARATION COSTS</b>						<b>1,561.35</b>
Land Rent (net acres)						240.00
Cash Overhead-----	15 % of preharvest costs & land rent					270.20
<b>TOTAL PREHARVEST COSTS</b>						<b>2,071.55</b>
<b>HARVEST COSTS*</b>						
Cut, pack, haul, cool and sell		900 cartons @		4.75 per carton		4,275.00
<b>TOTAL OF ALL COSTS</b>						<b>6,346.55</b>

**PROJECTED PROFIT OR LOSS PER ACRE**

		Price/ 35 lb. carton					Break-even \$/carton
		4.00	5.00	6.00	7.00	8.00	
Cartons per acre	500	-2447	-1947	-1447	-947	-447	8.89
	600	-2522	-1922	-1322	-722	-122	8.20
	700	-2597	-1897	-1197	-497	203	7.71
	800	-2672	-1872	-1072	-272	528	7.34
	900	-2747	-1847	-947	-47	853	7.05

\* Harvest cost depends upon the shipper, the field conditions, and the market value.



## IMPERIAL COUNTY LEAF LETTUCE CULTURE 2004-2005

Annual acreage, yield, and gross value of leaf lettuce  
per acre in Imperial County, CA (1999-2003)

Year	Acres	Yield/Acre*	Gross Value/Acre
2003	9,648	936	\$7,450
2002	7,625	923	\$9,469
2001	7,627	920	\$7,102
2000	7,688	895	\$5,415
1999	10,498	833	\$4,599

\*25 lb cartons (leaf and butter), 35 lb cartons (Romaine)  
Source: Imperial County Agricultural Commissioner's Reports 1999-2003

**YIELDS:** The term "leaf lettuce" includes greenleaf, redleaf, butter, and romaine (cos) types. Some lettuce growers plant endive, escarole, nappa and bok choy in the same fields as leaf lettuce. Each type has a different yield potential, but yields of 500 to 1300 cartons per acre are normal.

**ADDITIONAL PRODUCTS:** In addition to leaf lettuce shipped in cartons, in 2003 Imperial County Ag. Statistics list 35.7 million pounds of salad products with a gross value of \$13.9 million dollars. Spring Mix is another category with 5,400 acres with a gross value of \$3.2 million dollars. Spring Mix may consists of various mixtures of baby redleaf lettuce, baby greenleaf lettuce, baby romaine, mizuna, kale, arugula, beet tops, baby spinach, mustard, endive, tat-soi, frisee, chard and numerous other salad greens.

**VARIETIES:** *Shining Star Seminis; Green Vision Central Valley Seeds; Tehama Paragon; Plymouth Coastal Seeds; Marin Orsetti* and *Two Star Orsetti*.

Redleaf varieties are: *Deep Red Harris Moran; New Red Synergene; Red Tide Seminis; Red Rage Pybas* and *Vulcan Sakata*.

Butterhead varieties are: *Crosby Sunseeds; Connick Sunseeds; Optima Vilmorin; Baja Seminis* and *Encore Seminis*

Romaine varieties are: *Paris Island Cos various; King Henry Progeny; Conquistador Seminis; Green Forrest Central Valley; Triton Harris Moran; DF-7 Greengenes; King Louie Paragon; Darkland Cos Central Valley; Rubicon Paragon; Braveheart Seminis; Slugger Coastal Seeds; and Green Towers Harris Moran*



**PLANTING INFORMATION:** Some growers plant September 15 to December 5, while others concentrate mostly on October plantings. The crop is harvested December through February. The seed is normally planted at a 2- to 3-inch spacing within rows on 40- to 42-inch beds. There are two seed lines per bed normally spaced 13 inches between lines. Lettuce is normally planted using pelleted seed and a precision planter. At a 2-inch spacing 157,000 (157 M) seed will be needed. Seed is planted ¼ inch deep or less and sprinkler irrigated to emergence. After emergence, the field is converted to furrow irrigation. Plants are thinned to 6- to 10 inches within the row depending upon variety.

The weather may still be relatively hot during early October. Leaf lettuce varieties are often subject to thermodormancy problems under these conditions. Primed seed should be used to avoid the problem or the initial irrigation should be started late in the afternoon so that the seed will imbibe water and start to germinate during the cooler nighttime hours. Lettuce seed should not be planted into moist soil unless the sprinklers are started soon after planting. A delay of 10 to 12 hours may cause germination to start and the seed to die before irrigation is applied.

**FERTILIZERS:** Five hundred pounds of ammoniated phosphate 11-52-0 per acre are broadcast prior to listing the beds. Nitrogen is sidedressed just after thinning and during later growth stages. Early season lettuce requires less nitrogen than later planted lettuce. About 150 pounds of nitrogen (N) are used for the early season crop and 200 to 250 pounds N for late-season lettuce.

Lettuce is very sensitive to overdoses of ammoniacal fertilizers. Seedling injury will be expressed by root burn, yellowing of the leaves, and even dead plants. Fertilizer injury later in the season is expressed by wilting of the outer leaves and a rusty reddish discoloration in the middle of the plant root.

**SOILS:** Silt loams and sandy soils are preferred. The lighter soils provide better drainage during cold weather and warm up more readily. Lettuce has a moderately low degree of salt tolerance. Excess salinity results in poor seed germination and small heads.

**IRRIGATION:** Most growers use sprinkler irrigation for the first 5 to 7 days or until the seedlings emerge and the grower can "green line" the seed rows. The field is then converted to furrow irrigation for the remainder of the season.

Care must be taken not to oversaturate beds when growing early-season lettuce. Excess moisture favors the development of bottom rot (*Rhizoctonia solani*).

Gated pipe is also used, especially near harvest. The major benefits of gated pipe is to allow for uniform application of water down furrows and to maintain a dry head basin so that harvesting equipment can turn around on dry ground.



**PEST AND DISEASE CONTROL:** Insect pests include crickets, western flower thrips, silverleaf whitefly, cutworms, leafminers, salt marsh caterpillars, and beet armyworms. Cabbage loopers can be especially serious after thinning. Aphids and thrips are late-season insect pests that should be controlled.

Silverleaf whitefly can cause delayed maturity. Planting time applications of systemic neonicotinoid insecticide is used for control.

Insects and their damage are more visible in the mixed lettuce types and may cause poor quality and bad arrivals.

Pest control is more difficult to manage when growing leaf lettuce as compared with growing head lettuce. Leaf lettuce is often planted in small, 8 to 20 bed blocks. There are often several plantings made on different dates in the same fields. Pesticide drift onto non-target crops is a difficult problem to manage.

The most serious diseases affecting leaf lettuce are lettuce big vein virus (LBVV), bottom rot (*Rhizoctonia solani*), grey mold (*Botrytis cinerea*), and lettuce drop (*Sclerotinia sclerotiorum* and *S. minor*). Use mosaic-free seed (i.e., no virus in 30,000 seed) to prevent lettuce mosaic virus (LMV).

Powdery mildew (*Erysiphe cichoracearum*) and downy mildew (*Bremia lactuca*) may need to be controlled with fungicide applications to avoid economic damage.

Freeze injury on mature lettuce will be expressed as blistering and peeling of the epidermis, followed by browning of the tissues.

Tipburn is a physiological disorder caused by the lack of mobility of calcium in the leaves during warm weather and rapid growing conditions. There is presently no control of this condition.

**WEED CONTROL:** Most currently used herbicides can cause crop injury under certain conditions. Avoid high rates of herbicide on sandy soils, especially during hot weather. Currently, Kerb is available for chemigation weed control in lettuce. Timing of the chemigation is crucial to avoid damage to lettuce and to achieve good weed control. The timing varies with the stage of lettuce germination during different times of the lettuce-growing season. Apply six to eight hours of sprinkle irrigation after the chemigation. Consult the label and your PCA for current technology. Other herbicides commonly used are Balan and Prefar.

**HARVESTING:** Harvesting is done with ground pack crews (no machines). Leaf lettuce is hand-cut and harvested with 24 heads per carton. Weights per carton vary according to lettuce type. Redleaf, greenleaf, and butter lettuce weighs 25 pounds, and romaine cartons weigh 35-40 pounds. One-dozen count cartons are also offered. Romaine is occasionally packed in a "WGA crate" which contains 30 plants.

Leaf lettuce is almost always harvested to fill an order. A day's shipments would often include cartons of



each lettuce type; hence, the word "mixed" is sometimes used to describe the operation. Napa, bok choy, endive, and escarole are often grown in the same fields.

The cartons are vacuum cooled or hydrovac processed and shipped to markets in refrigerated trucks.

**POSTHARVEST HANDLING:** Leaf lettuce is even more perishable than head lettuce and should be cooled immediately after harvesting. Cooled cartons should be stored just above freezing at 98 percent relative humidity.

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For more information see “Leaf Lettuce Production in California”, DANR Publication 7216 available from the Imperial County Cooperative Extension Office or for a free download from the Internet go to <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.

**Brassicac**s 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.

**Trió** 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.