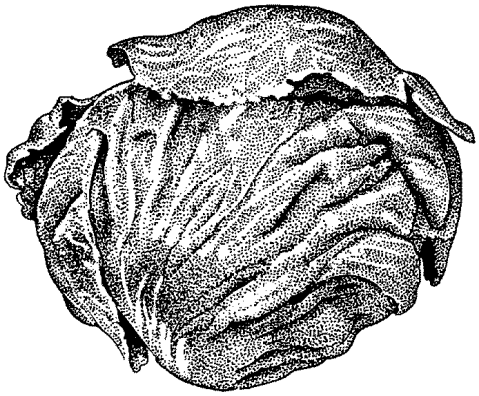
# U.C. COOPERATIVE EXTENSION

## SAMPLE COST TO ESTABLISH AND PRODUCE

# *ICEBERG 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.

# 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 |

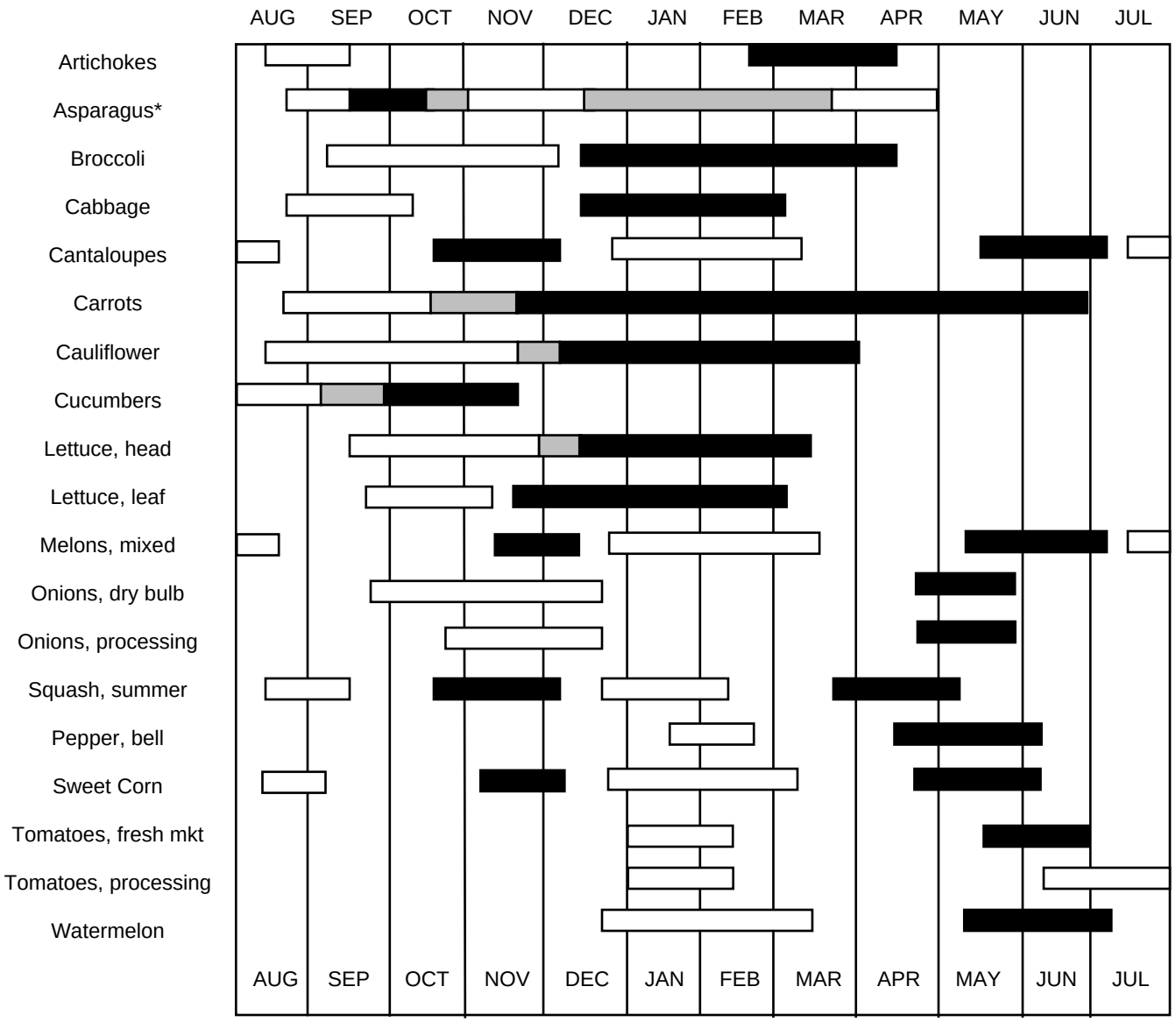
## HARVEST COSTS-FIELD CROPS

| | 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

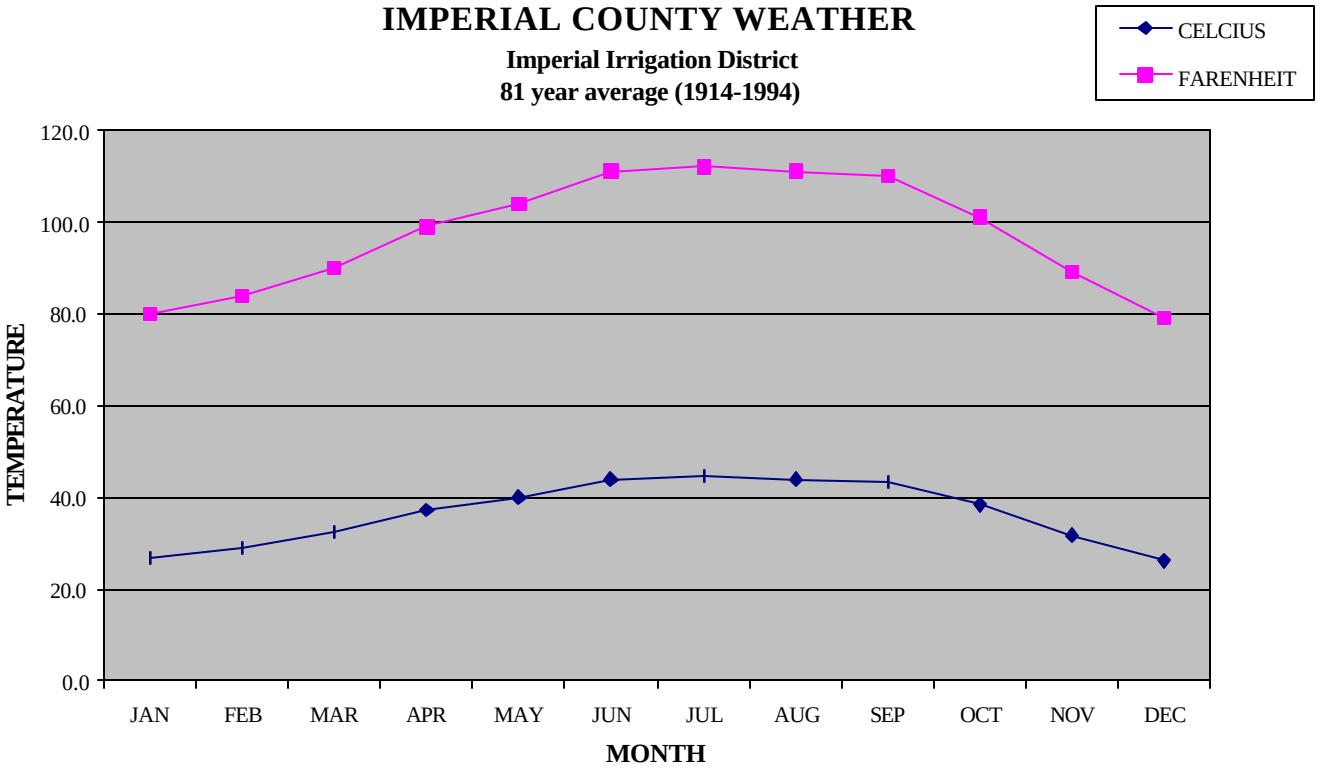
planting/harvesting

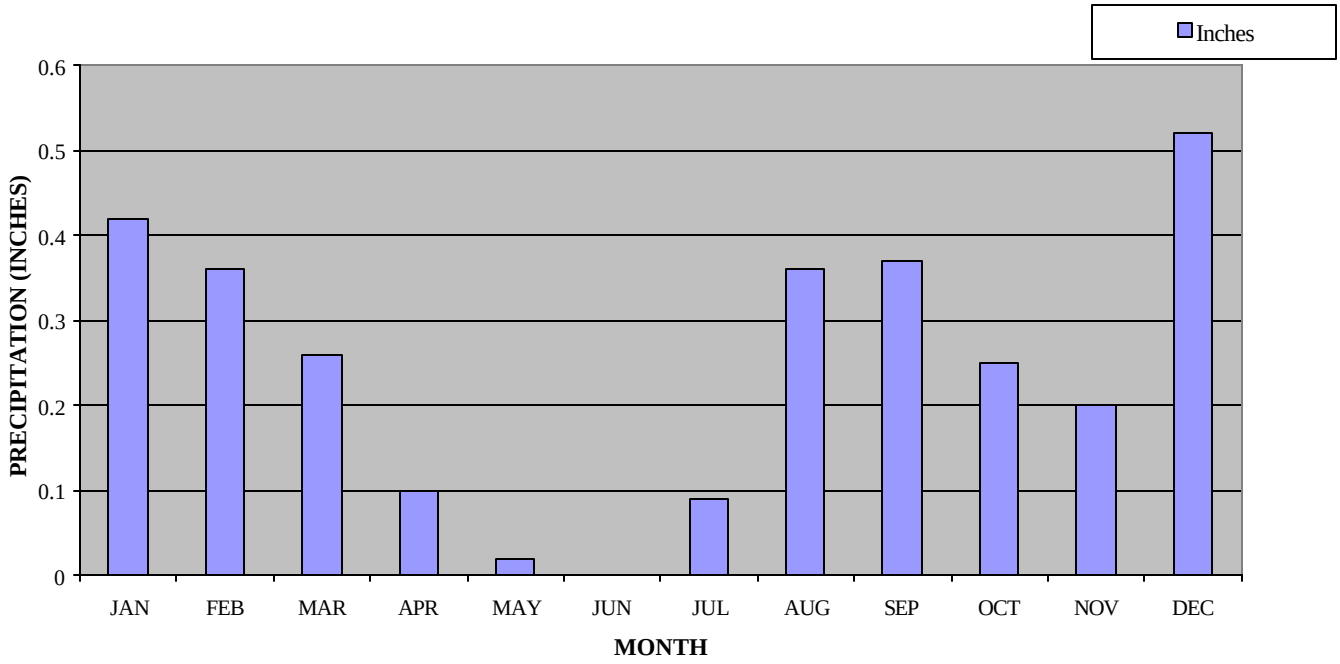
harvesting

* 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 WRAPPED ICEBERG LETTUCE PROJECTED PRODUCTION COSTS 2004-2005

Hand labor at $9.95 per hour ($6.75 plus SS,unemployment insurance, workman's compensation, and fringe benefits)
Yield--700 50 lb. cartons per acre 90-120 days to maturity. **40 Acre Field**

| 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 | | Water 1 ac/ft. | 16.00 | 1 | 9.95 | 25.95 |
| Disc 2x | 13.00 | | | | | 26.00 |
| Triplane | 12.00 | | | | | 12.00 |
| Spread fertilizer | 8.00 | 500 lb. 11-52-0 | 75.00 | | | 83.00 |
| List 40"/42" beds | 16.50 | | | | | 16.50 |
| **TOTAL LAND PREPARATION** | | | | | | **294.70** |
| **GROWING PERIOD** | | | | | | |
| Power mulch beds | 27.50 | | | | | 27.50 |
| Precision plant and | 22.00 | Coated seed 157M | 150.00 | | | 172.00 |
| inject insecticide | | Admire | 60.00 | | | 60.00 |
| Weed control/chemigation | | Herbicide | 35.00 | | | 35.00 |
| Sprinkler irrigate | 165.00 | | | | | 165.00 |
| Thin | | | | 13 | 129.35 | 129.35 |
| 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 | | 60 lb. N / UAN 32 | 22.80 | | | 22.80 |
| Hand weed 2x | | | | 10 | 99.50 | 99.50 |
| Irrigate 4x | | Water 3 ac/ft. | 48.00 | 2.5 | 24.88 | 72.88 |
| Gated pipe irrigation | 50.00 | | | | | 50.00 |
| Insect control 6x | 10.00 | Insecticides | 150.00 | | | 210.00 |
| Disease Control 1x | 11.50 | Fungicide | 10.00 | | | 21.50 |
| Ring roller cleanup | 7.50 | | | | | 7.50 |
| **TOTAL GROWING PERIOD** | | | | | | **1,183.63** |
| **GROWING PERIOD & LAND PREPARATION COSTS** | | | | | | **1,478.33** |
| Land Rent (net acres) | | | | | | 240.00 |
| Cash Overhead----- | 13 % of preharvest costs & land rent | | | | | 223.38 |
| **TOTAL PREHARVEST COSTS** | | | | | | **1,941.71** |
| **HARVEST COST*** | | | | | | |
| Cut, pack, haul, cool and sell | 700 wrapped cartons @ | | 5.25 | per carton | | 3,675.00 |
| **TOTAL ALL COSTS** | | | | | | **5,616.71** |

**PROJECTED PROFIT OR LOSS PER ACRE**
**Price/ 50 lb. carton (dollars)**

| | | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | Break-even $/carton |
|---|---|---|---|---|---|---|---|
| | **500** | -2067 | -1567 | -1067 | -567 | -67 | 9.13 |
| **Cartons** | **600** | -2092 | -1492 | -892 | -292 | 308 | 8.49 |
| **per** | **700** | -2117 | -1417 | -717 | -17 | 683 | 8.02 |
| **acre** | **800** | -2142 | -1342 | -542 | 258 | 1058 | 7.68 |
| | **900** | -2167 | -1267 | -367 | 533 | 1433 | 7.41 |

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

# IMPERIAL COUNTY ICEBERG LETTUCE CULTURE 2004-2005

Annual acreage, yield, and value of naked pack, wrapped, and bulk head lettuce in Imperial County, CA (1999-2003)

| Year | Acres | Yield/Acre* | Value/Acre |
|---|---|---|---|
| 2003 | 14,343 | | $4,137 |
| 2002 | 13,664 | | $11,368 |
| 2001 | 5,628 | 831 | $7,229 |
| 2000 | 8,860 | 670 | $4,757 |
| 1999 | 9,072 | 604 | $5,021 |

* Starting in 2001, all acres combined for all head lettuce types of pack.
Source: Imperial County Agricultural Commissioner's Reports 1999-2003

**PLANTING-HARVESTING DATES:** The planting period is from mid-September to mid-November. Early plantings (mid-September) are harvested in early December, while October plantings are harvested in January and February. Late November plantings are harvested in March.

**VARIETIES:** "Crisphead," "iceberg" and "head" lettuce are terms used to differentiate this type of lettuce from loose leaf or Romaine lettuces. Varieties are adapted to specific planting periods. Planting a variety out-of-slot will result in non-heading, puffiness and bolting. As the season progresses, temperatures change from extreme heat both night and day to cool days with nights near freezing. Moderately high temperatures can occur in early spring. Early plantings mature in less than 90 days while later ones require 120 days or more.

The following are commonly planted varieties and seed producers in italics: Raider *Seminis*; Mohawk *Seminis;* Wolverine *Seminis;* Westland *Orsetti;* Cibola *Paragon;* Honcho II *Seminis*; Kofa *Synergene*; Yuma *Harris Moran*; Winterhaven *Various*; Red Coach 74 *Various;* Valley Queen *Paragon;* Coyote *Seminis;* Bubba *Seminis*; Lighthouse *Paragon*; Jupiter *Paragon*; Grizzly *Seminis*; Havalina *Seminis*; Desert Storm *Harris Moran*; and Diamond *Coastal Seeds*.

Non-primed, natural lettuce seed may be susceptible to thermodormancy when ambient temperatures are above 90°F for an extended period of time. Priming will allow the seed to overcome thermodormancy and germinate well at high temperatures. Several companies offer priming. Thermodormancy can also be broken by starting the initial irrigation in the late afternoon whereby the seed imbibes water and germinates during the cooler hours of the night.

**PLANTING INFORMATION:** Most of the lettuce is planted using pelleted seed and a precision planter. Seed are planted 2 to 3 inches apart within-rows on 40 to 42 inch beds. At a 2-inch spacing there will be 157,000 (157 M) seed per acre. Cost of seed per acre varies with variety coating, spacing, and seed enhancement or priming treatments.

**SOILS:** Lettuce prefers silt loams and sandy soils. 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 sprinklers for the first 5 to 7 days or until the seedlings emerge and the grower can identify a green line down the seed rows. The field is then converted from sprinklers to furrow irrigation for the remainder of the season.

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

Gated pipe is also used, especially near harvest. The major benefits of gated pipe are to allow for uniform application of water down furrows and to maintain a dry head basin so that harvest equipment can turn around on hard ground. The irrigation labor costs used also include shovel work, grader work, and pipe setting.

**FERTILIZERS:** Five hundred pounds of ammoniated phosphate 11-52-0 are usually broadcast prior to listing. Nitrogen (N) is sidedressed just after thinning and during later growth. Early, warm-season lettuce requires less N than that grown in January and February. About 150 pounds actual N is used early, while 200 to 250 pounds actual N are applied during cold weather.

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.

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

The silverleaf whitefly has caused slow growth, reduced head size, and delayed maturity of the crop. A systemic neonicitinoid insecticide applied at planting is commonly used to combat whitefly.

The most serious diseases affecting iceberg 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).

Fusarium wilt, caused by *Fusarium oxysporum* f.sp. *lactucum*, has been identified in isolated locations of Imperial County, although, it has not been reported in Imperial Valley. This pathogen has been responsible for substantial losses to lettuce production in Arizona.

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. Normally freeze injury is confined to the cap and wrapper leaves.

Tipburn is a physiological disorder caused by the lack of mobility of calcium in the heads during warm weather and rapid growing conditions. Presently, there is no control for lettuce tipburn.

**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 commonly used herbicides are Balan and Prefar.

**HARVESTING:** Head or iceberg lettuce is field packed into cartons. Roughly 40 percent of the crop is wrapped. In most cases, cut and trimmed heads are stacked on a table of a field-harvesting machine. Workers then wrap and seal individual heads in film or plastic bags. The wrapped heads are packed either 24 or 30 heads per carton.

An alternative method is trimmed heads (with the wrappers leaves removed) are placed in plastic bags by field workers. The heads are packed in cartons by count.

For ground harvest also called “naked pack”, crews of approximately 20 to 30 people are split up into small units called trios. There are two cutters and a packer in a trio. They often rotate jobs and are normally paid by the number of cartons packed. The solid lettuce heads are cut, trimmed to 4 to 5 wrapper leaves and packed 24 per carton. A carton weighs a minimum of 50 pounds gross weight.

Lettuce is vacuum cooled prior to storage in a cold room. Vacuum cooling removes field heat in roughly 15 minutes.

Many companies bulk harvest lettuce. Bulk harvested lettuce may be “trimmed and cored” lettuce. The heads are loaded into bulk bins, which are trucked to a processing plant. The heads are cooled, washed, and precut into various types of retail packages for the food service industry. Fast food outlets, restaurants, institutional use, airlines, and schools use large volumes of salad products.

**POSTHARVEST HANDLING:** Lettuce is highly perishable and should be cooled as soon as possible after harvesting. Vacuum cooling will reduce product temperature to 34° F and then it should be stored just above freezing at 98 percent relative humidity.

Lettuce harvested at prime maturity with no major defects may be held for 2 to 3 weeks at 34°F. At 37 ° F, shelf life is reduced to 1 to 2 weeks.

Russet spotting is a disorder caused by storing lettuce in containers or cold rooms where there is ethylene gas present. Ripening fruits and gasoline engines can generate ethylene. Brown stain is a storage disorder caused by high carbon dioxide levels in the cold room.

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For more information on iceberg lettuce, see "Iceberg Lettuce Production in California", DANR Publication 7215 available from the Imperial County Cooperative Extension Office or for a free download from the Internet go to http://anrcatalog.ucdavis.edu/specials.ihtml .

## 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.