U.C. COOPERATIVE EXTENSION

SAMPLE COST TO ESTABLISH AND PRODUCE

ARTICHOKEs

IMPERIAL COUNTY – 2003

Prepared by:
Keith S. Mayberry  Farm Advisor, U.C. Cooperative Extension, Imperial County
Herman Meister  Agronomy Advisor, U.C. Cooperative Extension, Imperial County

For an explanation of calculations used for the study refer to the attached General Assumptions or call the author, Keith S. Mayberry, at the Imperial County Cooperative Extension office, (619)352-9474 or e-mail at ksmayberry@ucdavis.edu.

The University of California Cooperative Extension in compliance with the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and the Rehabilitation Act of 1973 does not discriminate on the basis of race, creed, religion, color, national origins, or mental or physical handicaps in any of its programs or activities, or with respect to any of its employment practices or procedures. The University of California does not discriminate on the basis of age, ancestry, sexual orientation, marital status, citizenship, medical condition (as defined in section 12926 of the California Government Code) or because the individuals are disabled or Vietnam era veterans. Inquiries regarding this policy may be directed to the Personnel Studies and Affirmative Action Manager, Agriculture and Natural Resources, 2120 University Avenue, University of California, Berkeley, California 94720, (510) 644-4270.

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

We wish to thank growers, pest control advisors, chemical applicators and dealers, custom farm operators, fertilizer dealers, seed companies, contract harvesters, equipment companies, and the Imperial County Agricultural Commissioners office for providing us with the data necessary to compile this circular. Without them 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. They do 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. In most of the crop guidelines contained in this circular we used 13% of the total of land preparation, growing costs and land rent to estimate overhead.

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.

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.

Herman S Meister & Keith S. Mayberry
(Principal researchers and editors)
Vegetable Crops and Agronomy Advisors

Contributors: Eric T. Natwick
Tom A. Turini
Jose L. Aguiar
Khaled M. Bali
Juan N Guerrero
### 2002-2003 Field/Vegetable Prevailing Rate for Field Operations

#### IMPERIAL COUNTY

<table>
<thead>
<tr>
<th>OPERATION</th>
<th>$/ACRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plow</td>
<td>30.50</td>
</tr>
<tr>
<td>Subsoil, 2nd gear</td>
<td>39.00</td>
</tr>
<tr>
<td>Landplane</td>
<td>12.75</td>
</tr>
<tr>
<td>Triplane</td>
<td>11.25</td>
</tr>
<tr>
<td>Chisel 15&quot;</td>
<td>25.00</td>
</tr>
<tr>
<td>Wil-Rich chisel</td>
<td>16.00</td>
</tr>
<tr>
<td>Big Ox</td>
<td>24.00</td>
</tr>
<tr>
<td>Slip plow</td>
<td>41.00</td>
</tr>
<tr>
<td>Pull/disc borders</td>
<td>6.75</td>
</tr>
<tr>
<td>Make cross checks (taps)</td>
<td>6.25</td>
</tr>
<tr>
<td>Break border</td>
<td>6.00</td>
</tr>
<tr>
<td>Disc, stubble</td>
<td>21.00</td>
</tr>
<tr>
<td>Disc, regular</td>
<td>12.50</td>
</tr>
<tr>
<td>Corrugate</td>
<td>11.00</td>
</tr>
<tr>
<td>Disc, regular with ring roller</td>
<td>13.50</td>
</tr>
<tr>
<td>List 30&quot; beds 12-row</td>
<td>15.00</td>
</tr>
<tr>
<td>List 40&quot; beds 8-row</td>
<td>15.00</td>
</tr>
<tr>
<td>Float</td>
<td>10.00</td>
</tr>
<tr>
<td>Disc, borders</td>
<td>7.00</td>
</tr>
<tr>
<td>Dump (scraper) borders</td>
<td>14.50</td>
</tr>
</tbody>
</table>

#### LIGHT TRACTOR WORK

<table>
<thead>
<tr>
<th>OPERATION</th>
<th>$/ACRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power mulch dry</td>
<td>25.00</td>
</tr>
<tr>
<td>Power mulch with herbicide</td>
<td>28.00</td>
</tr>
<tr>
<td>Shape 30&quot; 6 row</td>
<td>10.75</td>
</tr>
<tr>
<td>Shape 40&quot; 4 row</td>
<td>10.75</td>
</tr>
<tr>
<td>Plant 30&quot; beds nonprecision</td>
<td>20.00</td>
</tr>
<tr>
<td>Plant 40&quot; beds nonprecision</td>
<td>18.00</td>
</tr>
<tr>
<td>Precision plant 30&quot; beds</td>
<td>22.00</td>
</tr>
<tr>
<td>Precision plant 40&quot; beds</td>
<td>20.00</td>
</tr>
<tr>
<td>Mulch plant wheat</td>
<td>19.50</td>
</tr>
<tr>
<td>Plant alfalfa (corrugated)</td>
<td>17.50</td>
</tr>
<tr>
<td>Plant bermudagrass (flat)</td>
<td>13.75</td>
</tr>
<tr>
<td>Plant sudangrass</td>
<td>14.75</td>
</tr>
<tr>
<td>Cultivate 30&quot; beds 4-row</td>
<td>16.00</td>
</tr>
<tr>
<td>Cultivate 40&quot; beds 4-row</td>
<td>14.00</td>
</tr>
<tr>
<td>Spike 30&quot; beds 4-row</td>
<td>13.25</td>
</tr>
<tr>
<td>Spike 40&quot; beds 4-row</td>
<td>11.25</td>
</tr>
<tr>
<td>Spike and furrow out 30&quot; 4-row</td>
<td>14.00</td>
</tr>
<tr>
<td>Spike and furrow out 40&quot; 4-row</td>
<td>12.00</td>
</tr>
<tr>
<td>Furrow out 30&quot; beds 4-row</td>
<td>13.25</td>
</tr>
<tr>
<td>Furrow out 40&quot; beds 4-row</td>
<td>11.25</td>
</tr>
<tr>
<td>Lilliston 30&quot; beds 6-row</td>
<td>13.00</td>
</tr>
<tr>
<td>Lilliston 40&quot; beds 4-row</td>
<td>13.00</td>
</tr>
<tr>
<td>Lilliston 30&quot; beds with/herbicides 6-row</td>
<td>15.00</td>
</tr>
</tbody>
</table>

### HEAVY TRACTOR WORK & LAND PREPARATION

<table>
<thead>
<tr>
<th>OPERATION</th>
<th>$/ACRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lilliston 40&quot; beds with/herbicides 4-row</td>
<td>15.00</td>
</tr>
<tr>
<td>Inject fertilizer &amp; furrow out 30&quot; beds 4-row</td>
<td>15.00</td>
</tr>
<tr>
<td>Inject fertilizer &amp; furrow out 40&quot; beds 4-row</td>
<td>13.00</td>
</tr>
<tr>
<td>Fertilize dry &amp; furrow out 30&quot; beds</td>
<td>17.00</td>
</tr>
<tr>
<td>Fertilize dry &amp; furrow out 40&quot; beds</td>
<td>15.00</td>
</tr>
<tr>
<td>Flat inject fertilizer NH₃</td>
<td>15.00</td>
</tr>
<tr>
<td>Broadcast dry fertilizer</td>
<td>7.00</td>
</tr>
<tr>
<td>Ground spray 40&quot; 8-row</td>
<td>12.00</td>
</tr>
<tr>
<td>Ground spray 30&quot; 8-row</td>
<td>14.00</td>
</tr>
<tr>
<td>Chop cotton stalks</td>
<td>13.75</td>
</tr>
</tbody>
</table>

### HARVEST COSTS Field Crops

#### BY UNIT

<table>
<thead>
<tr>
<th>CROP</th>
<th>$/UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combine alfalfa seed</td>
<td>41.75/acre</td>
</tr>
<tr>
<td>Windrow alfalfa seed</td>
<td>17.50/acre</td>
</tr>
<tr>
<td>Rake bermudagrass</td>
<td>5.00/acre</td>
</tr>
<tr>
<td>Swath bermudagrass</td>
<td>13.50/acre</td>
</tr>
<tr>
<td>Swath sudangrass</td>
<td>11.25/acre</td>
</tr>
<tr>
<td>Rake sudangrass</td>
<td>5.25/acre</td>
</tr>
<tr>
<td>Swath alfalfa</td>
<td>8.00/acre</td>
</tr>
<tr>
<td>Rake alfalfa</td>
<td>4.50/acre</td>
</tr>
<tr>
<td>Bale (all types of hay- small bale)</td>
<td>0.65/bale</td>
</tr>
<tr>
<td>Bale (large bale 4X4)</td>
<td>10.00/bale</td>
</tr>
<tr>
<td>Bale (large bale Jr. 3X4)</td>
<td>9.00/bale</td>
</tr>
<tr>
<td>Bale (large bale 3X4)</td>
<td>6.00/bale</td>
</tr>
<tr>
<td>Bale (large bale Jr. 3X4)</td>
<td>5.50/ton</td>
</tr>
<tr>
<td>Bale (large bale Jr. 3X4)</td>
<td>40.00/acre</td>
</tr>
<tr>
<td>Bale (large bale Jr. 3X4)</td>
<td>40.00/acre</td>
</tr>
<tr>
<td>Bale (large bale Jr. 3X4)</td>
<td>175/load</td>
</tr>
<tr>
<td>Bale (large bale Jr. 3X4)</td>
<td>300/load</td>
</tr>
</tbody>
</table>

### MISCELLANEOUS OPERATIONS BY THE HOUR

<table>
<thead>
<tr>
<th>OPERATION</th>
<th>$/HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor grader</td>
<td>48.00</td>
</tr>
<tr>
<td>Backhoe</td>
<td>45.00</td>
</tr>
<tr>
<td>Water truck</td>
<td>40.00</td>
</tr>
<tr>
<td>Wheel tractor</td>
<td>35.00</td>
</tr>
<tr>
<td>Scraper</td>
<td>36.00</td>
</tr>
<tr>
<td>Versatile</td>
<td>56.00</td>
</tr>
<tr>
<td>D-6</td>
<td>56.00</td>
</tr>
<tr>
<td>D-8</td>
<td>70.00</td>
</tr>
<tr>
<td>Buck ends of field</td>
<td>28.00</td>
</tr>
<tr>
<td>Pipe setting (2 men)</td>
<td>37.00</td>
</tr>
<tr>
<td>Laser</td>
<td>88.00</td>
</tr>
<tr>
<td>Work ends (disc out rotobucks)</td>
<td>35.00</td>
</tr>
</tbody>
</table>
ARTICHOKE CULTURE 2002-2003

ACREAGE AND YIELD There are roughly 300-400 acres of artichokes grown in Imperial County. Yields vary from a low yield of 300 cartons per acre to a high of over 1100 cartons per acre. Often higher yields are produced in fields utilizing drip irrigation.

Fields are planted in late August or early September. Harvest begins in late fall or early spring depending upon planting date and whether a growth regulator to increase earliness of bud formation was applied.

The desert-grown artichokes compete in the marketplace with those produced in the Central Coast of California. When cold weather and freezes occur in coastal California, a high market value for the desert crop can be realized. Conversely when production increases in coastal California in mid-spring, the value of desert-grown artichokes diminishes rapidly.

Warm weather increases the toughness and decreases flavor in artichoke buds. For this reason desert-grown ‘chokes will seldom be marketable after early April.

VARIETIES Desert-grown artichokes are direct-seeded or grown from transplants. Few, if any, are grown from vegetative cuttings, a practice commonly used in coastal California.

Imperial Star is a public variety that may be grown from seed or used to produce transplants. This variety produces a large volume of glossy-green, large-to-extra-large buds (3½-4½"

PLANTING INFORMATION Artichokes are grown on a wide range of bed widths from 44 to 80 inches, with 72 inches being common. Some growers make 36- or 40-inch beds and plant on the alternate beds. This system allows for irrigation by furrow or by sprinklers. Narrow-bed spacing (<60") has not worked out as well. Crowding of the plants causes smaller buds to develop and harvesting is more difficult due to foliage density.

Artichoke seed is quite large (roughly 13,000 seed/lb.). Seed may be planted hill-drop style with 2 to 4 seed every 30 inches in-row, or planted every 6 inches and thinned. Final plant spacing is generally around 30 inches in-row; however, some growers plant closer or farther depending upon personal preference. While the overall number or artichokes is increased with narrow spacing, the average size of the buds is reduced. The percent germination on artichoke seed is low, especially in hot weather. Artichokes are cool-season vegetables grown out-of-slot in order to hit a specific market window. This should be kept in mind as stand failures may occur under adverse conditions even with sprinkler irrigation.

UC Cooperative Extension-Imperial County Vegetable Crops Guidelines 2002-03
Precision air or belt planters are commonly used for artichokes. Some random flow plate planters are also used.

Transplants are usually placed 30 inches apart on 80-inch beds. This practice would require 2,489 plants per acre.

**SOILS AND IRRIGATION** Artichokes are grown on a wide range of soil types including sandy loams and silty clays, provided that soil moisture is adequate. Drip irrigation is often used to supply near optimum soil moisture.

Artichokes are moderately salt tolerant. Yield depressions in bud weight occur beyond an EC₆ of 6 mmhos/cm (dS m⁻¹). A salinity induced calcium deficiency has been identified which is similar to tipburn in lettuce.

During the initial part of the growing season, high temperatures reduce plant growth. Sixty-day-old plants may not be much larger than a dinner plate (10-12" diameter). As the weather cools, plants grow more vigorously. During the rapid vegetative growth stage, artichokes will need lots of water. As the crop approaches maturity, irrigate every few days.

**FERTILIZATION** Preplant applications of 200 pounds P₂O₅ as 11-52-0 per acre are broadcast and listed into the beds. Another alternative is to apply 10-34-0 liquid fertilizer injected into the beds at planting.

During the season, an additional 150-200 pounds actual nitrogen (N)/ac is often used. Commonly used nitrogen sources are liquid ammonium nitrate or UAN 32 solution.

**PEST CONTROL** Crickets, darkling ground beetles, grasshoppers and armyworms may attack artichokes at planting. Foliage pests include painted lady butterfly, cutworms, and saltmarsh caterpillar. Aphids may colonize some plants but often ladybeetles move in and control the problem.

The artichoke plume moth has not become an established pest in the desert. The best way to keep the moth from becoming a problem is to not bring in artichoke transplants from infested areas and to avoid over-summering of established plants.

Damping off (*Pythium* spp.) may cause seedling or transplants to wilt or collapse. Avoid saturated soil conditions.

There are some unidentified root-rotting fungi that occur on occasion.

**GROWTH REGULATORS** Gibberellic acid (GA) is sometimes used to force bud initiation.
for late fall, and winter harvest. Three applications of GA at 20 ppm are made starting roughly 8 weeks after transplanting or when the plants are approximately dinner plate size (10-12" diameter). GA is applied to plants as an aqueous spray in sufficient quantity to wet the foliage.

**HARVESTING** Artichokes are harvested when there are sufficient numbers of primary or "king" buds of sufficient size to warrant their removal. King buds may grow as large as 8-10 inches in diameter and still be marketable. The sizes most preferred by the buyers are extra large 24's (4-4½" diameter) and large 36's (3½-4" diameter). Other sizes sold are medium 48's and occasionally jumbo 18's and small 60's. Bags of small, loose "baby artichokes" containing 70-120 buds may be sold if the price warrants the expense of harvesting.

Artichokes are subject to bruising during harvesting and packing. The damage is not expressed until several days after harvest. Bruises will appear as darkened off-color areas that can become a site for infection by molds and bacteria.

Harvesting is normally by hand. The buds are cut from the plant with a sharp knife with a 2-inch stem remaining on the choke. The chokes are placed in bins, trailers or directly on field packing machines, then hand-sorted, sized and packed in waxed, fiberboard cartons.

Full cartons of chokes should be hydrocooled soon after harvest and then held in cold storage until transit to terminal markets.

"Frost-kissed” chokes are those that have been exposed to a mild frost. The epidermal layers blister and whiten after exposure. After a few days the bracts turn a bronze color. While the frost changes the cosmetic appearance, the quality of the choke is unaffected.

Harvesting overly mature buds should be avoided because they are woody, strong flavored, and can influence the buyer to avoid future purchases.

**POSTHARVEST HANDLING** Normally artichokes should not be stored for long periods of time. Chokes should be held at temperatures just above freezing and 95-100 percent relative humidity. Cartons should be well ventilated to allow for water escape after hydrocooling and for the release of heat and gases produced by respiration of the buds.

For more information see “Artichoke Production in California”, DANR Publication 7221 available from the Imperial County Cooperative Extension Office or on the Internet at http://anrcatalog.ucdavis.edu/specials.ihtml
Yield—600 23 lb. cartons per acre  Imperial Star variety  direct seeded

<table>
<thead>
<tr>
<th>OPERATION</th>
<th>Cost Type</th>
<th>Materials</th>
<th>Hand Labor</th>
<th>Cost Per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAND PREPARATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stubble disc</td>
<td>21.00</td>
<td></td>
<td></td>
<td>21.00</td>
</tr>
<tr>
<td>Subsoil</td>
<td>39.00</td>
<td></td>
<td></td>
<td>39.00</td>
</tr>
<tr>
<td>Disc 2x</td>
<td>12.50</td>
<td></td>
<td></td>
<td>25.00</td>
</tr>
<tr>
<td>Triplane 1x</td>
<td>11.25</td>
<td></td>
<td></td>
<td>22.50</td>
</tr>
<tr>
<td>Border, cross check &amp; break borders</td>
<td>19.00</td>
<td></td>
<td></td>
<td>19.00</td>
</tr>
<tr>
<td>Flood irrigate</td>
<td></td>
<td>Water 1 ac/ft.</td>
<td>16.00</td>
<td>1</td>
</tr>
<tr>
<td>Disc 2x</td>
<td>12.50</td>
<td></td>
<td></td>
<td>25.00</td>
</tr>
<tr>
<td>Triplane 1x</td>
<td>11.25</td>
<td></td>
<td></td>
<td>11.25</td>
</tr>
<tr>
<td>Fertilizer, spread</td>
<td>7.00</td>
<td>500 lb. 11-52-0</td>
<td>58.75</td>
<td></td>
</tr>
<tr>
<td>List 80&quot; beds</td>
<td>19.00</td>
<td></td>
<td></td>
<td>19.00</td>
</tr>
<tr>
<td>TOTAL LAND PREPARATION</td>
<td></td>
<td></td>
<td></td>
<td>272.75</td>
</tr>
</tbody>
</table>

| GROWING PERIOD | | | |
| Precision plant and shape | 26.00 | Seed 0.85 lb @ 300 | 255.00 | 281.00 |
| Apply herbicide | 12.50 | Kerb | 70.00 | 82.50 |
| Sprinkler irrigate | 185.00 |           |            | 185.00 |
| Thin | | | 5 | 46.25 | 46.25 |
| Apply growth regulator 3x | 10.00 | Giberellic acid | 27.00 | 57.00 |
| Cultivate and reshape 2x | 15.00 |           |            | 30.00 |
| Fertilize and furrow out 1x | 16.50 | 100 lb. N @ .32 | 32.00 | 48.50 |
| Water-run fertilizer | | 60 lb. N @ .32 | 19.20 | 19.20 |
| Hand weed 2x | | | 8 | 74.00 | 74.00 |
| Layby herbicide | 12.00 | Goal | 16.00 | 28.00 |
| Irrigate 6x | | Water 3 ac/ft. | 48.00 | 7 | 64.75 | 112.75 |
| Gated pipe | 55.00 | | |
| Chop residue 2x | 13.75 | | |
| TOTAL GROWING PERIOD | | | 1046.70 |

| GROWING PERIOD & LAND PREPARATION COSTS | | |
| Land Rent (net acres) | 225.00 |
| Cash Overhead------ | 13 % of preharvest costs & land rent | 200.78 |
| TOTAL PREHARVEST COSTS | 1745.23 |

| HARVEST COST | | |
| Cut, pack, haul, cool and sell | 600 cartons@ | 4.25 per carton | 2550.00 |
| TOTAL OF ALL COSTS | | | 4295.23 |

<table>
<thead>
<tr>
<th>PROJECTED PROFIT OR LOSS PER ACRE</th>
<th>Price / 23 lb. carton (dollars)</th>
<th>Break-even $/carton</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.00</td>
<td>6.00</td>
<td>7.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Harvest costs may vary with the shipper, the field conditions and the market.

U.C. Cooperative Extension and Imperial County Circular 104-V 2002-03