

U.C. COOPERATIVE EXTENSION

SAMPLE COST TO ESTABLISH AND PRODUCE

ARTICHOKES



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.

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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 nd gear.....	45.00
Subsoil 3 rd 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

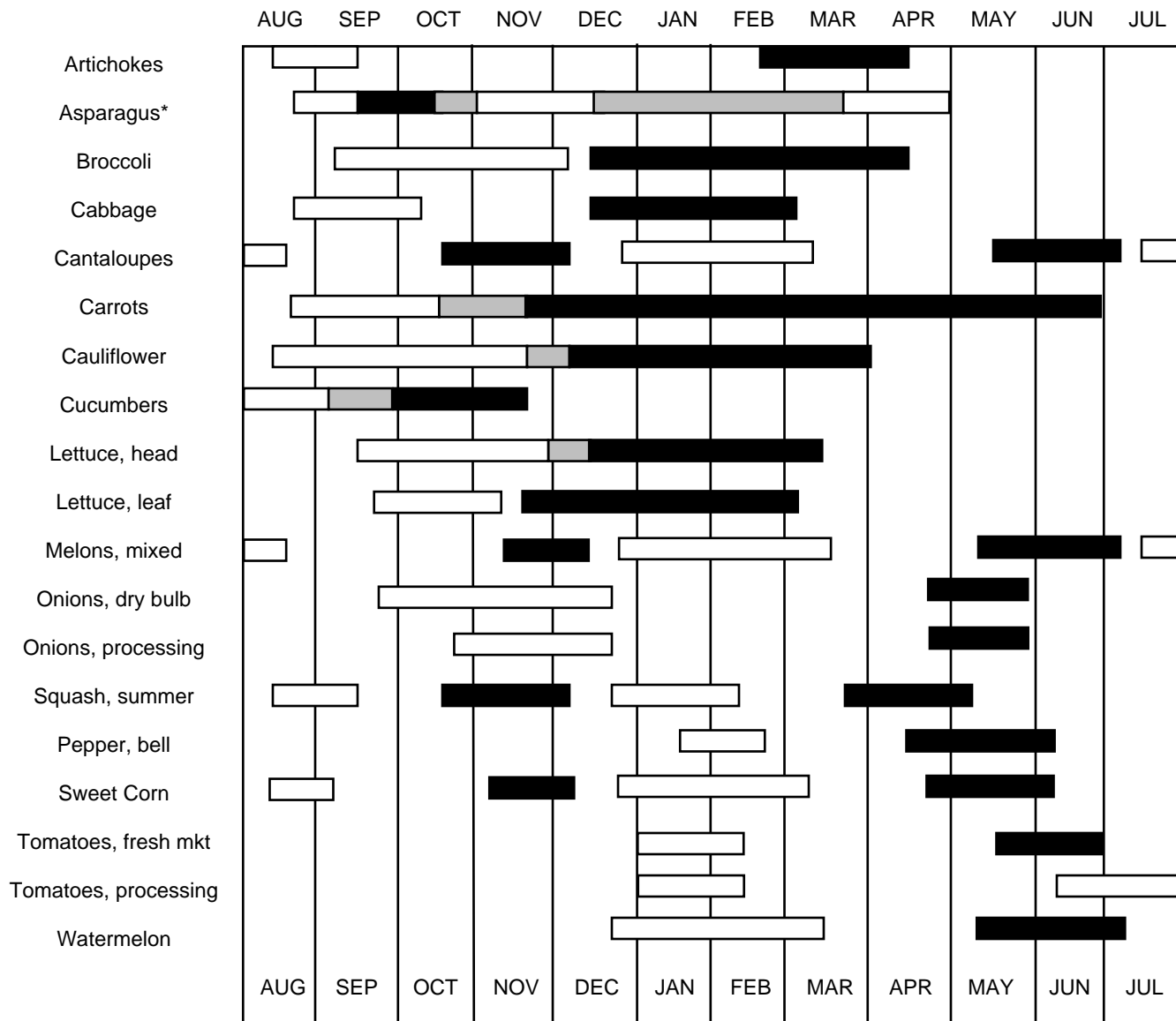
Windrow alfalfa seed.....	17.50/acre
Combine alfalfa seed.....	41.00/acre
Swath bermudagrass.....	13.75/acre
Rake bermudagrass.....	5.50/acre
Swath sudangrass.....	11.25/acre
Rake sudangrass.....	6.00/acre
Swath alfalfa.....	8.75/acre
Rake alfalfa.....	5.00/acre
Bale (all types of hay- small bale).....	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 wheat16.00 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 st /2 nd03cts/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

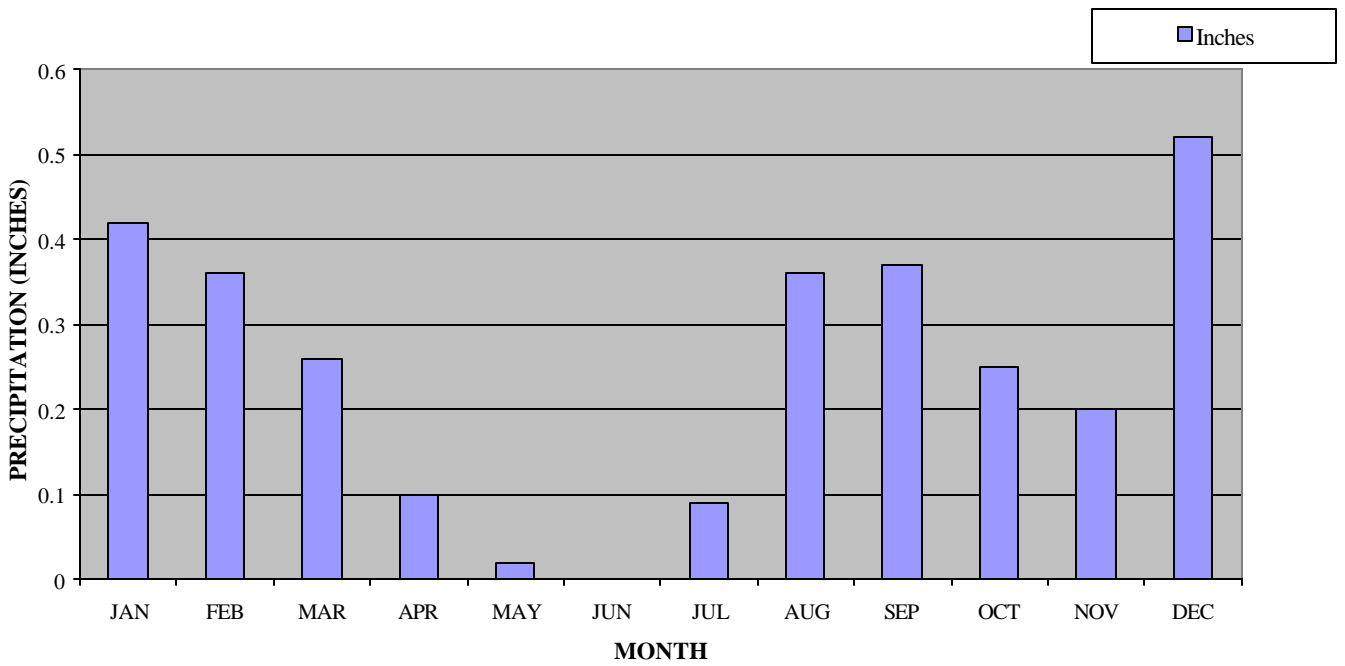
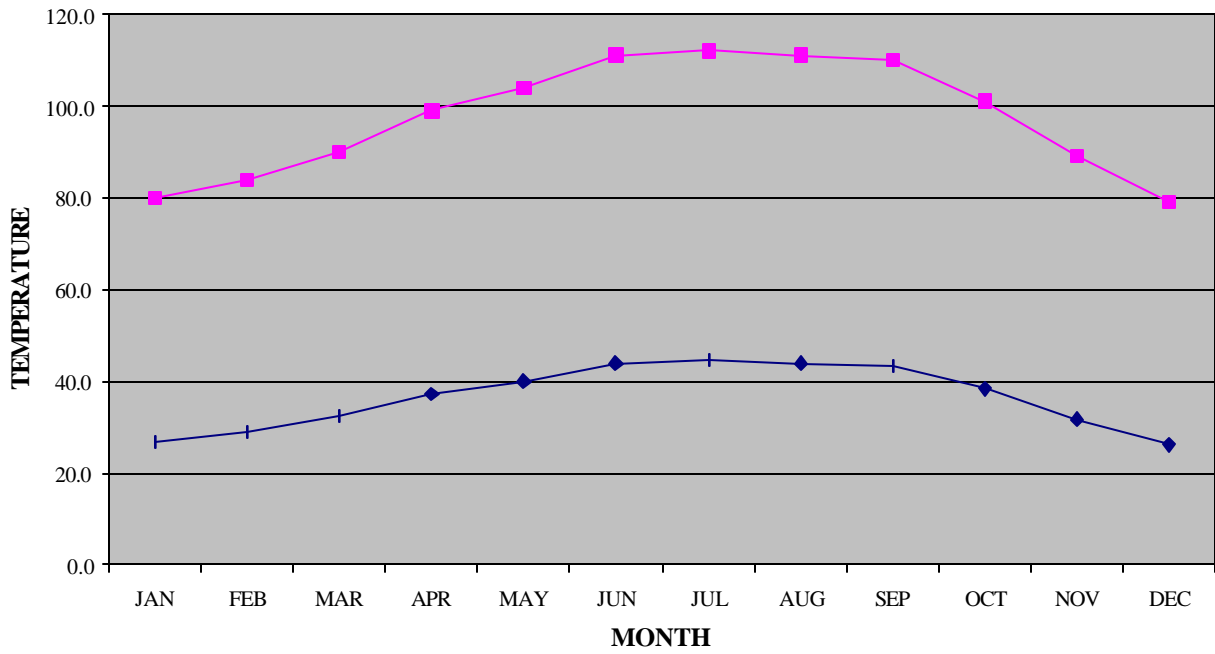
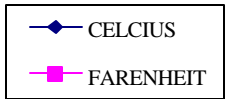


MONTH

- 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) required¹ per acre for common plant spacing combinations within rows and between beds. Commonly coded as “M” or 1000 seed

Plant spacing within rows ² (inches)	Spacing between beds ³ (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 DIRECT SEEDED ARTICHOKE PROJECTED PRODUCTION COSTS 2004-2005

40 Acre Field

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

Yield--600 23 lb. cartons per acre

Imperial Star Variety

Direct Seeded

OPERATION	Cost	Materials		Hand Labor		Cost Per Acre
		Type	Cost	Hours	Dollars	
LAND PREPARATION						
Stubble disc	24.50					24.50
Big Ox	25.00					25.00
Disc 2x / ring roller	15.00					30.00
Triplane 1x	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 / ring roller	15.00					30.00
Triplane 1x	12.00					12.00
Fertilizer, spread	8.00	500 lb. 11-52-0	75.00			83.00
List 80" beds	20.00					20.00
TOTAL LAND PREPARATION						286.20
GROWING PERIOD						
Precision plant and shape	26.00	Seed 0.85 lb @ 300	255.00			281.00
Weed control 1X ground	12.50	Kerb	70.00			82.50
Sprinkler irrigate	185.00					185.00
Thin				5	49.75	49.75
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	18.00	100 lb. N / UAN 32	38.00			56.00
Water-run fertilizer		60 lb. N / UAN 32	22.80			22.80
Hand weed 2x				8	79.60	79.60
Layby herbicide	12.00	Goal	12.50			24.50
Irrigate 6x		Water 3 ac/ft.	48.00	3.5	34.83	82.83
Gated pipe irrigation	55.00					55.00
Chop residue	16.00					16.00
TOTAL GROWING PERIOD						1,021.98
GROWING PERIOD & LAND PREPARATION COSTS						1,308.18
Land Rent (net acres)						225.00
Cash Overhead-----		13 % of preharvest costs & land rent				199.31
TOTAL PREHARVEST COSTS						1,732.49
HARVEST COST*						
Cut, pack, haul, cool and sell		600 cartons@	4.25 per carton			2,550.00
TOTAL OF ALL COSTS						4,282.49

PROJECTED PROFIT OR LOSS PER ACRE

Price / 23 lb. carton (dollars)

		Price / 23 lb. carton (dollars)					Break-even \$/carton
		5.00	6.00	7.00	8.00	9.00	
Cartons per acre	400	-1432	-1032	-632	-232	168	8.58
	500	-1357	-857	-357	143	643	7.71
	600	-1282	-682	-82	518	1118	7.14
	700	-1207	-507	193	893	1593	6.72
	800	-1132	-332	468	1268	2068	6.42

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



IMPERIAL COUNTY ARTICHOKE CULTURE 2004-2005

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 1,100 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 was applied to increase earliness of bud formation.

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 (3¼-4½ diameter). Imperial Star was released by the University of California from selections made from advanced breeding material obtained from the USDA. Emerald is another variety available as seed for local use. There are a number of other cultivars grown locally, many of which are grown by individual shippers as proprietary lines.

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 of 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.

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. Many companies have switched from seed to transplants to be sure of having a good plant stand.

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 EC_e of 6 mmhos/cm ($dS\ m^{-1}$). A salinity induced calcium deficiency has been identified which is similar to tipburn in lettuce. The base of the bracts of some leaves in the buds become black, shriveled and water-soaked in appearance.

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 P_2O_5 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) per acre 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 avoid importing artichoke transplants from infested areas in to the low desert, 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.

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 (3¾" 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 adversely influence the buyer to avoid future purchases from the shipper.

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>



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.

Tri-o 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.