

U.C. COOPERATIVE EXTENSION

SAMPLE COST TO ESTABLISH AND PRODUCE

MARKET ONIONS



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.

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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

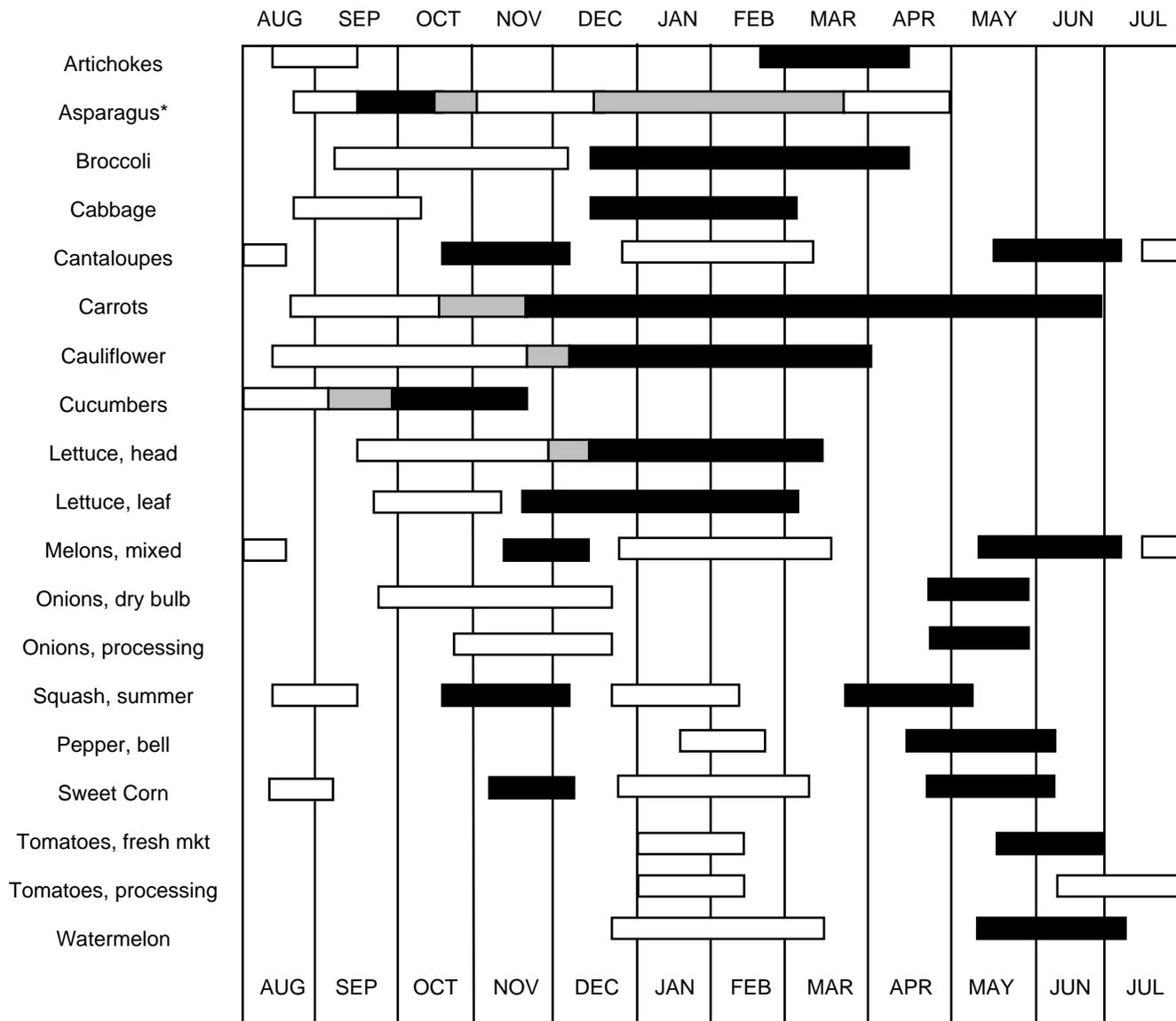
Windrow alfalfa seed.....	17.50/acre
Combine alfalfa seed.....	41.00/acre
Swath bermudagrass.....	13.75/acre
Rake bermudagrass.....	5.50/acre
Swath sudangrass.....	11.25/acre
Rake sudangrass.....	6.00/acre
Swath alfalfa.....	8.75/acre
Rake alfalfa.....	5.00/acre
Bale (all types of hay- small bale).....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

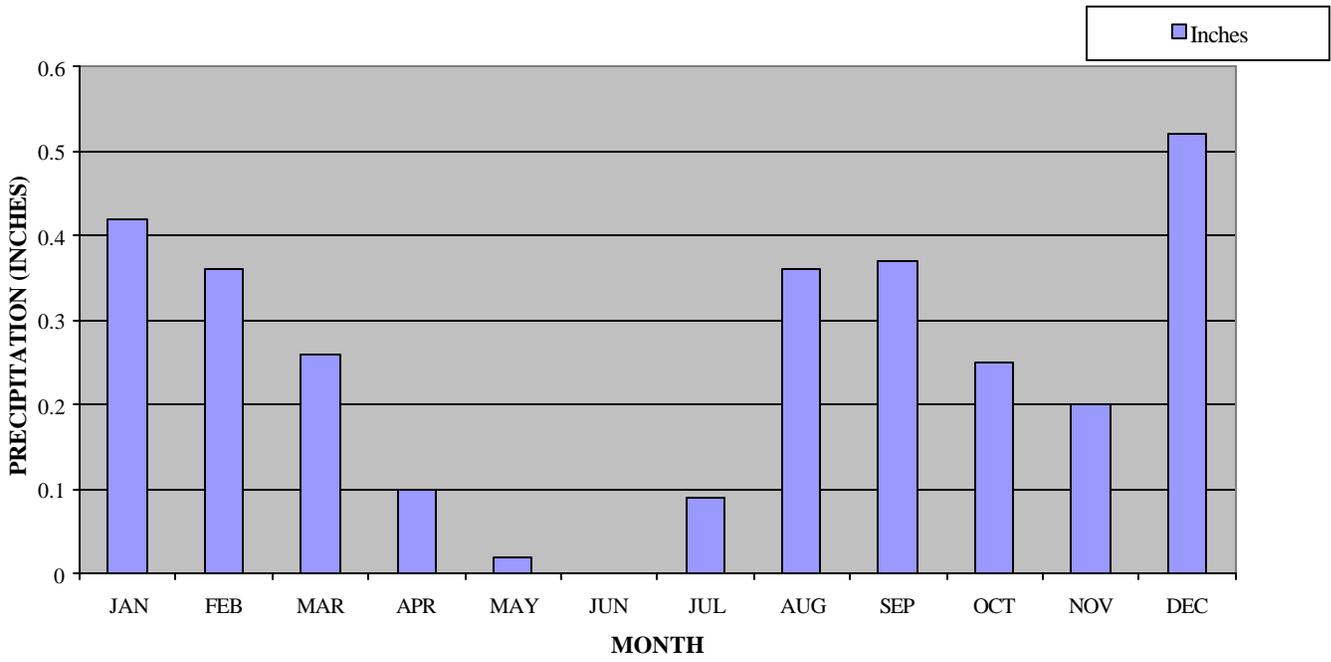
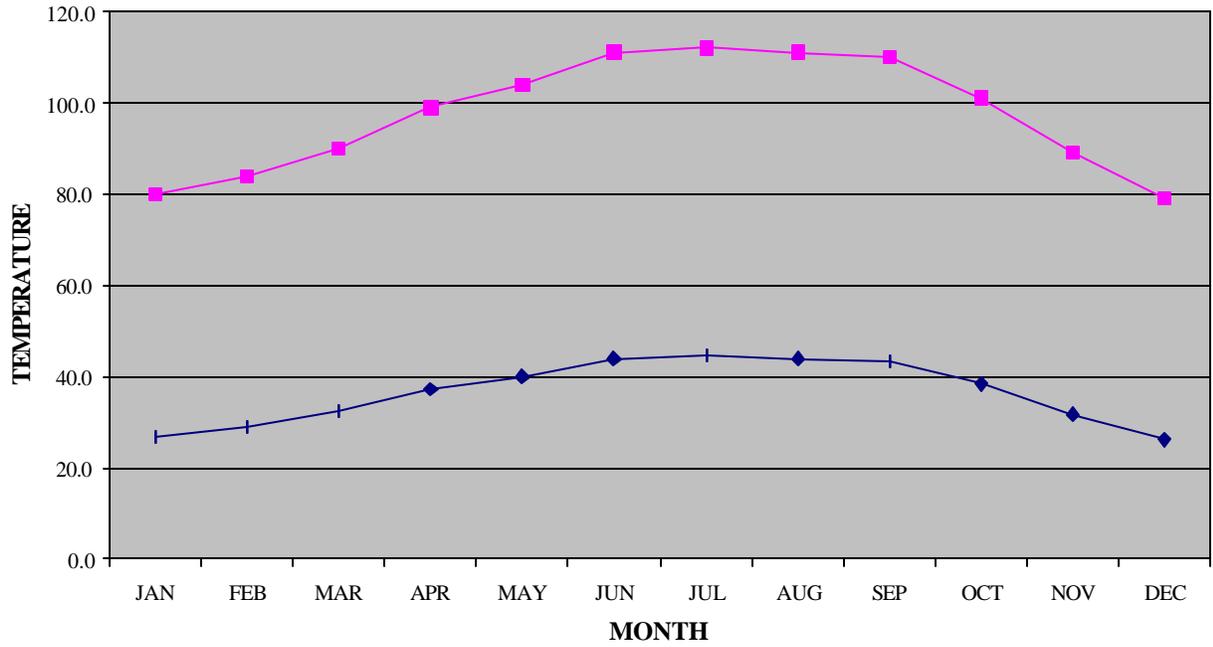
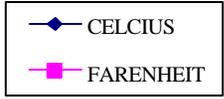


MONTH

- 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 MARKET ONION PROJECTED PRODUCTION COSTS 2004-2005

40 Acre Field

Hand labor at \$9.95per hour (\$6.75 plus SS, unemployment insurance, workman's compensation,supervision and fringe benefits).
Yield--1000 50 lb. sacks per acre

OPERATION	Cost	Materials		Hand Labor		Cost Per acre
		Type	Cost	Hours	Dollars	
LAND PREPARATION						
Stubble disc / ring roller	24.50					24.50
Big Ox	25.00					25.00
Disc 2x / ring roller	15.00					30.00
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
Spread fertilizer	8.00	500 lb. 11-52-0	75.00			83.00
List 40" beds	16.50					16.50
TOTAL LAND PREPARATION						278.70
GROWING PERIOD						
Power mulch beds	27.50					27.50
Precision plant*	20.00	Coated seed 150M	260.00			280.00
Weed control- pre-emergence	12.50	Herbicide	100.00			112.50
Sprinkler irrigate	175.00					175.00
Chemigation/herbicide		Herbicide	12.50			12.50
Chemigation insecticide		insecticide	5.50			5.50
Cultivate 2x	14.00					28.00
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
Weed control- layby & post emergence	12.50	Herbicide	30.00			55.00
Hand weed 1x				7	69.65	69.65
Irrigate 10x		Water 4.5ac/ft.	72.00	6	59.70	131.70
Disease control 4x	11.50	Fungicides	125.00			171.00
TOTAL GROWING PERIOD						1,187.75
GROWING PERIOD & LAND PREPARATION COSTS						1,466.45
Land Rent (net acres)						210.00
Cash Overhead-----	13 % of preharvest costs & land rent					217.94
TOTAL PREHARVEST COSTS						1,894.39
HARVEST COST **						
Dig, top, grade, haul and sell		1000 packout sacks @	3.25		per sack	3,250.00
TOTAL OF ALL COSTS						5,144.39

*Raw seed is estimated at \$225 / acre.

PROJECTED PROFIT OR LOSS PER ACRE

Price/ 50 lb. sack (dollars)

		Price/ 50 lb. sack (dollars)					Break-even \$/sack
		4.00	5.00	6.00	7.00	8.00	
Cartons per acre	700	-1369	-669	31	731	1431	5.96
	800	-1294	-494	306	1106	1906	5.62
	900	-1219	-319	581	1481	2381	5.35
	1000	-1144	-144	856	1856	2856	5.14
	1100	-1069	31	1131	2231	3331	4.97

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



IMPERIAL COUNTY MARKET ONION CULTURE 2004-2005

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

Year	Acres	Yield/Acre*	Value/Acre
2003	5,292	808	\$9,292
2002	3,879	953	\$5,804
2001	4,426	878	\$4,504
2000	5,526	777	\$3,349
1999	6,042	825	\$4,333

*50-pound sacks

Source: Imperial County Agricultural Commissioner's Reports 1999-2003

PLANTING: Most of the acreage is direct seeded from early October to mid-November. Onions are grown on 40-42-inch beds. The number of rows varies with the grower but 4 rows per bed is normal. Some plantings have been made with three seed lines on narrow beds. Seed are precision planted using Milton, Stanhay, and various air planters at a target spacing of 3½ inches between seed. Both pelleted and raw seed are used. Onions are normally not thinned. This makes seed spacing crucial for obtaining a good stand. Poor spacing will produce a high number of skips, or small/deformed onions, thus lowering packout.

Germination of onion seed is normally lower than many other vegetables. Therefore, growers should work closely with seed companies to insure that the seed meets their needs and adjust seeding rates accordingly.

Seed should be sown about ½ inch deep. In UC research plots, there was a tendency for flatter onions when seed was sown shallower. With seed deeper than ¾ inch, there was a reduction in stand and a tendency to develop deeper bulbs. While deeper bulbs are preferable, care must be taken to keep the soil moist while the bulbs are expanding or misshapen bulbs will result.

VARIETIES: Onions are sensitive to day length and temperature. Only early maturing, short-day types are grown. Most of the local sweet varieties are derivatives of "grano" and "granex" types or their hybrid crosses. Bulb shape will vary and includes "flat" (flattened sphere), "deep



flat", "top", or "globe" shapes. The primary use of Imperial Sweet onions is fresh cut for raw use in salads, on hamburgers, sandwiches, dips, garnishes and various marinades. They also make outstanding onion rings.

The more popular varieties include: Goldrush *Sunseeds*; Henry's Special *Sunseeds*; Timon *D. Palmer*; Monsoon *Seminis*; Colossal *Sunseeds*; Sweet Sunrise *Sunseeds*; Don Victor *Sunseeds*; Nikita *Sunseeds*; Safari *Sunseeds*; and Texas Early Grano 502 *various*.

Some onions are used for the fresh onion ring market. Varieties and selections, which have single centers and thick succulent rings, are desired for the fried onion ring trade. Multiple centers can also occur in onions exposed to a hard freeze during the winter.

Some white and red onions are grown and shipped with the yellows. White Supreme *Sunseeds*; Reina Blanca *Sunseeds*; Texas Early White (*various*); Kristal *Sunseeds*; and Contessa *Seminis* are white varieties.

Red Grano *various*; Mata Hari *Sunseeds*; and Rojo *Sunseeds* are commonly used red varieties.

Occasionally a grower will use transplants for production of jumbo and colossal sized onions. The decision to use transplants usually depends upon the condition of the onion crops in Texas, Mexico, and Georgia.

SOILS: Medium-textured sandy loams are the most desirable soils for onion culture. Onions are shallow-rooted and need a friable soil that retains moisture well, especially after cultivation. Avoid salty, hard crusting, or weed-infested soils. Onions may be grown on sandy soils provided that moisture is made available whenever needed.

IRRIGATION: Onions are generally sprinkler irrigated to emergence. It may take 10 days for the seeds to germinate, or even longer with November plantings. During this time, seeds must not be allowed to dry out and the soil surface should be moist. Onions should never suffer from lack of water. Stressing onions for water before maturity increases pungency and may cause splitting. Weather and soil conditions determine the number of irrigations required to grow a crop which number between 7 and 12.

FERTILIZER: Generally 500 pounds of 11-52-0 ammoniated phosphate per acre are broadcast prior to listing. During the growing season 150 to 200 pounds of actual nitrogen per acre are applied. Late applications of nitrogen tend to cause re-greening and may contribute to bulb splitting.

PEST AND DISEASE CONTROL: Mites, thrips, armyworms, leafminers, and maggots are the major insect pests of onions. Fields should be checked regularly for these pests.



Downy mildew (*Peronospora destructor*) and *Stemphylium* leaf spot (*Stemphylium botryosum*) are the

UC Cooperative Extension-Imperial County Vegetable Crops Guidelines Aug 2004-05



major fungal pests of onions. These diseases can be very destructive if left unchecked. Pink root (*Pyrenochaeta terrestris*) is a soil-borne disease affecting onions; crop rotation and resistant varieties should be used to suppress the problem.

Botrytis bulb rot (*Botrytis allii*) can damage market onions. To reduce Botrytis bulb rot incidence and severity, avoid late season irrigations and heavy or late applications of nitrogen, harvest only when crop is mature, and only store after the neck tissue is well cured.

Nematodes can cause damage in onions. However, this problem rarely occurs due to the late-fall planting period.

WEED CONTROL: Hand weeding is often very destructive to onion stands, but may be used one time to remove large weeds that were not controlled with herbicide or cultivation. Herbicide use is essential to maximize onion yield. Chemigation of Goal and Buctril looks promising as a method of applying herbicide for early weed control in onions. Follow the label directions closely to achieve the best weed control and the least crop injury.

HARVESTING: As a rule, harvesting takes place from late March through May depending upon weather. Onion tops begin to bend at the neck and fall over as the bulbs mature. Careful evaluation must be made for the last irrigation. Pulling the water too soon will reduce yield; irrigating too late will cause splitting, delay maturity, and can increase the incidence of decay. Earlier crops tend to command the highest prices and often fields are harvested before prime maturity. A field is considered to be ready after 25 to 40 percent of the tops have fallen over.

Bulbs are undercut and dug with a rod weeder (counter clockwise rotating bar) and allowed to dry overnight. Crews hand-top the bulbs with clippers. The onions are sacked in burlap. The bulbs are too succulent and tender to grade and pack immediately. They are stored in the field 3 to 5 days to cure before final packing. After field curing, the sacks are then dumped into bulk trucks and hauled to sheds for sizing, re-sacking in mesh bags or cartons, loading, and shipping. The standard sizes packed include Colossal (greater than 4 inches diameter), Jumbo (3-4 inches), Medium (2-3.5 inches), Repacks (1 $\frac{3}{4}$ inches), and Boilers (less than 2 inches).

Field packing is increasingly more important. Burlap sacks of cured onions are sorted, sized, and packed on field harvest machines making a packing shed unnecessary. The most common sizes packed are Jumbo, Mediums, and Repackers. The major advantage of field packing is a lower overall cost per sack. The major disadvantage of field packing is a reduced ability to cull undesirable bulbs. Sorting belts on field-pack machines are short, making the time allowed for removing culls less than in sheds. Onions are normally transported on open, flatbed trucks to terminal markets for retail distribution.



POST HARVEST HANDLING: Onions are cooled by placing pallets of sacks in the shade. Good air circulation is crucial to reduce rot. No additional cooling is used for fresh onions. The shelf life is short, usually a month to six weeks. For best storage onions should be held at 32°F and 60-65 percent relative humidity.

Black mold (*Aspergillus niger*) is a serious postharvest disease that is favored by high temperatures and high humidity. The fungus is soilborne and may persist on crop debris from year-to-year. Bulbs become infected via the neck tissues as they start to mature and fall over. The main control measure is rapid curing and drying at temperatures below 86°F. These conditions seldom occur during onion harvesting in the low desert.

For more information on dry market onions, see “Fresh Market Bulb Onion Production in California”, DANR Publication 7242 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.

Brassicacs 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.