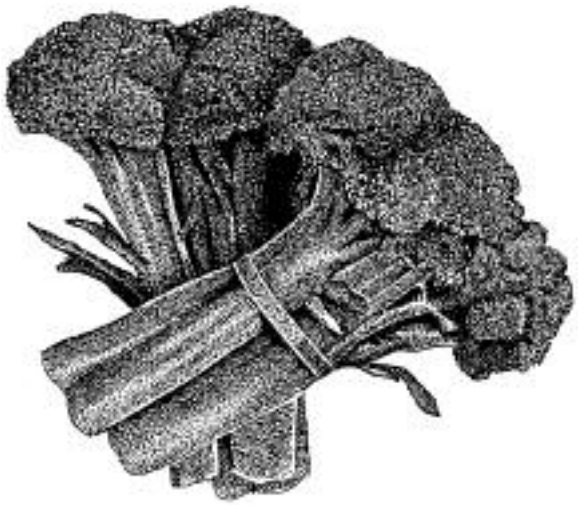
U.C. COOPERATIVE EXTENSION

SAMPLE COST TO ESTABLISH AND PRODUCE

BROCCOLI



IMPERIAL COUNTY – 2003

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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.

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.

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2002-2003 Field/Vegetable Prevailing Rate for Field Operations
IMPERIAL COUNTY

HEAVY TRACTOR WORK & LAND PREPARATION

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

LIGHT TRACTOR WORK

Power mulch dry	25.00
Power mulch with herbicide	28.00
Shape 30” 6 row	10.75
Shape 40” 4 row	10.75
Plant 30” beds nonprecision	20.00
Plant 40” beds nonprecision	18.00
Precision plant 30” beds	22.00
Precision plant 40” beds	20.00
Mulch plant wheat	19.50
Plant alfalfa (corrugated)	17.50
Plant bermudagrass (flat)	13.75
Plant sudangrass	14.75
Cultivate 30” beds 4-row	16.00
Cultivate 40” beds 4-row	14.00
Spike 30” beds 4-row	13.25
Spike 40” beds 4-row	11.25
Spike and furrow out 30” 4-row	14.00
Spike and furrow out 40” 4-row	12.00
Furrow out 30” beds 4-row	13.25
Furrow out 40” beds 4-row	11.25
Lilliston 30” beds 6-row	13.00
Lilliston 40” beds 4-row	13.00
Lilliston 30” beds with/herbicides 6-row	15.00
Lilliston 40” beds with/herbicides 4 -row	15.00
Inject fertilizer & furrow out 30” beds 4-row	15.00
Inject fertilizer & furrow out 40” beds 4-row	13.00
Fertilize dry & furrow out 30” beds	17.00
Fertilize dry & furrow out 40” beds	15.00
Flat inject fertilizer NH_3	15.00
Broadcast dry fertilizer	7.00
Ground spray 40” 8-row	12.00
Ground spray 30” 8-row	14.00
Chop cotton stalks	13.75

HARVEST COSTS Field Crops

	BY UNIT
Combine alfalfa seed	41.75/acre
Windrow alfalfa seed	17.50/acre
Rake bermudagrass	5.00/acre
Swath bermudagrass	13.50/acre
Swath sudangrass	11.25/acre
Rake sudangrass	5.25/acre
Swath alfalfa	8.00/acre
Rake alfalfa	4.50/acre
Bale (all types of hay- small bale)	0.65/bale
Haul & stack hay – small bale	0.25/bale
Bale (large bale 4X4)	10.00/bale
Bale (large bale Jr. 3X4)	9.00/bale
Stack & load large bale	6.00/bale
Dig sugar beets	2.60/clean ton
Haul sugar beets	2.45/clean ton
Combine wheat	15 per acre + 0.55 /cwt over 1 ton
Haul wheat	5.50/ton
Combine bermudagrass seed 1st time	40.00/acre
Combine bermudagrass seed 2st time	25.00/acre
Haul bermudagrass seed (local)	175/load
Haul bermudagrass seed (Yuma)	300/load

MISCELLANEOUS OPERATIONS BY THE HOUR

Motor grader	48.00
Backhoe	45.00
Water truck	40.00
Wheel tractor	35.00
Scraper	36.00
Versatile	56.00
D-6	56.00
D-8	70.00
Buck ends of field	28.00
Pipe setting (2 men)	37.00
Laser	88.00
Work ends (disc out rotobucks)	35.00

FRESH MARKET BROCCOLI CULTURE 2002-2003

Annual acreage, yield, and value of fresh market broccoli in Imperial County, CA (1997-2001)

Year	Acres	Yield/Acre*	Gross Value/Acre
2001	7,764	500	$3,270
2000	11,349	404	$2,706
1999	13,603	428	$2,625
1998	9,589	541	$4,778
1997	7,613	522	$4,705

* 26-pound cartons

Source: Imperial County Agricultural Commissioners Reports 1997-2001

PLANTING-HARVESTING DATES Broccoli is planted beginning early September and continues through early December. Normal harvesting begins early December and is completed by mid-March. A few late-planted fields (maturing in April) tend to produce short plants with a purplish cast and irregular-sized beads on the broccoli heads if the weather is hot during head formation. Sometimes early-planted fields develop "brown bead", a physiological disorder thought to be the result from lack of calcium uptake and excessive heat during head formation.

VARIETIES Captain *Seminis*; Legacy *Seminis;* Green Belt *Syngenta*; Everest *Syngenta*; Marathon *Sakata;* Patriot *Sakata;* Nomad *Sakata;* Signal *Syngenta*; Coronado *Seminis;* Liberty *Seminis*; Triathlon *Sakata*; Ninja *Sakata;* General *Seminis;* Gypsy *Sakata**;*** and Major *Seminis*

Almost any commercial broccoli variety will produce a crop when planted late August to mid-November, however, many varieties are best adapted to early-, mid-, or late-season planting slots. The highest yield and most desirable head quality will be achieved by selecting the proper variety for a given planting date.

The ideal broccoli head has a compact, dome-shape and has small-to-medium, uniform beads. A dome shape of the head is preferred because dew or rainwater will run off the heads instead of promoting fungal and bacterial growth. The ideal stem is smooth with relatively few leaves. Removing leaves results in stem scars when stripping off leaves during packing. Heads should mature uniformly, allowing for once-over harvesting. However, most fields are harvested twice. Heads may be dark green or have a purplish cast. Either color is acceptable. However, mixtures of green and purple detract from the appearance of a packed carton.

Broccoli grown for the “crown cut” market is becoming more common. Crown-cut packaging requires that the stem be approximately 5 inches in length.

PLANTING INFORMATION Nearly 100% of the broccoli crop is direct seeded. A mechanical precision planter or an air planter is often used to sow the crop. Seed are placed up to a ¼ inch deep on 40-inch beds (two seed lines per bed). Spacing between seed lines is usually about 13 inches. Broccoli is planted to stand (no thinning). Normal plant spacing is 4.5 to 5 inches apart. Plant spacing within rows varies according to grower preference. Factors to consider in determining plant spacing are percent-inbred seed-count, seedbed texture, planting period, insect pressure, and variety.

Inbred seed of some varieties produces marketable broccoli heads while others produce plants with very small, non-salable heads. University research has shown that plants develop larger heads with wider spacing and more compact heads with narrow spacing. Improper plant spacing often results in reduced yields due to the production of heads that are either too large or too small.

Some varieties grown under unfavorable climatic conditions produce large stems (1½"or more), which are objectionable to consumers. Wide plant spacing may also contribute to "hollow stem" in broccoli, a condition that reduces product value.

In order to precision plant, broccoli seed must be sized and closely matched to the hole size in a Stanhay planter belt. Skips or doubles will occur when seed size and belt hole size do not match. Seed and equipment dealers usually have testing equipment to evaluate your needs.

Natural or non-pelleted seed is typically used for broccoli planting. Seed is sold in units of one thousand (M). Broccoli seed will germinate at temperatures of 40-95°F.

"Cat eye" (also called "starring") is a condition where some beads prematurely break into yellow flower. Some varieties have a tendency to develop this defect more quickly than others. A yellow-green color on the sides of the beads is not considered a defect. This condition is the result of lack of exposure of the beads to light during growth.

SOILS Broccoli grows best on well-drained soils; however, it will tolerate a wide range of soil textures. Excellent broccoli crops have been produced on soils ranging from dune sand to silty clay. When grown on silty clay soils, it is necessary to prepare a fine seedbed in order to precision plant effectively. Broccoli has greater salt tolerance than lettuce, carrots or onions.

IRRIGATION Sprinkler irrigation is normally used for stand establishment in the Imperial Valley; furrow irrigation is frequently used in Yuma, Arizona. After sprinkling and seedling emergence the field is converted to furrow irrigation. Broccoli is irrigated 6-8 times during the season.

FERTILIZERS Five hundred pounds of ammoniate phosphate (11-52-0) are normally broadcast prior to listing the beds. This provides ample nutrients for the crop until the first cultivation and sidedressing. Some growers prefer to add small amounts of nitrogen through the sprinklers or in the first irrigation (water-back) after sprinkling. About 80 pounds (units) of nitrogen (N) per acre are applied in a single sidedress application. UAN 32 or AN 20 are popular nitrogen fertilizers. If needed, additional N may be applied later in the irrigation water. Broccoli is not a heavy user of fertilizer compared to crops such as cauliflower or tomatoes.

PEST CONTROL Late-season broccoli is not prone to suffer significant damage from insects. However, early season plantings are more likely to be attacked by flea beetles and worms. Cabbage loopers, armyworms, salt-marsh caterpillars, cutworms, flea beetles and aphids can cause extensive damage unless controlled.

The silverleaf whitefly can cause substantial damage to broccoli seedlings due to massive feeding pressure. Whitefly feeding can cause a 2- to 3-week delay in the normal maturity of the crop, completely throwing plantings out of their targeted market windows. In addition, "white stalk" of broccoli has developed on some plantings. This disorder is believed to be a reaction from a toxin that results from whitefly feeding. There are systemic insecticides that can alleviate the problem.

Blind bud is a condition where the growing point of a seedling has been damaged. The leaves thicken and enlarge, but there is no head formation.

Downy mildew (*Peronospora parasitica)* is the major fungal disease in broccoli. University research has shown that foliage can suffer a substantial amount of mildew lesions without affecting yield or quality. Mildew-tolerant varieties are available.

Black rot (*Xanthomonas campestris* pv. *campestris*) occurs occasionally in Imperial County. It is usually introduced to a farm through infected seed or transplants. Field conditions are not usually conducive for development of this disease in the desert. Use disease-free planting material.

Cladosporium spp. are often surface contaminants on broccoli heads especially during rainy periods or when there is heavy morning dew.

Herbicides are fairly effective at controlling weeds in broccoli with the exception of London rocket and shepherd's purse. Hand weeding is often necessary to remove weeds that develop during the winter.

HARVESTING Broccoli is normally field-packed. A crop will be harvested twice with roughly a 10-day period between the first and second cut. Over-maturity is a major problem, especially in warmer weather. There is a tendency to plant too many acres in broccoli because it's an easy crop to grow. Most growers either ship the product themselves or have a contract with a shipper.

Broccoli heads are removed by hand by snapping the stem. Leaves are stripped from the stem and the heads and placed on the table of a field-harvesting machine.

Heads are chosen on the basis of size and shape. Heads should be 3 to 8 inches in diameter. Heads should also be free from defects such as "cat eye", broken florets, dirt, debris, and irregular bead size

Normally, bunches are comprised of 2-4 heads with 8 inches in stem length and are secured together with a rubber band. If the market price is high, more heads may be used to make a bunch. Broccoli is packed in 26-pound waxed-fiberboard carton containing 14 or 18 bunches.

Broccoli sold for export costs more to harvest and pack as many markets have specific size requirements for heads and stalk length. The criteria may vary with the buyer.

A small amount of the crop is sold as field-cut "florets." The loose florets are placed in mesh bags and packed in 9-12 pound cartons containing 3-4 bags each. There is also some "crown cut" broccoli sold. Crown-cut broccoli consists of the top dome with no more than 5 inches of length including stem. While crown-cut broccoli commands a high market price, the harvesting process is slow and meticulous. Crown-cut buyers have very demanding standards.

POSTHARVEST HANDLING Broccoli requires rapid cooling to insure preservation of quality. Harvested cartons should be taken to the cooler immediately. Liquid-icing is the standard cooling method. The process consists of injecting ice/water slush into waxed cartons. This provides immediate cooling of the product because the slush contacts a very high proportion of the product surface area. Broccoli cartons should never be allowed to set for more than an hour on the dock before cooling. Immediately after icing broccoli should be taken into refrigerated storage. Failure to cool broccoli quickly will cause a loss of quality and/or shelf life.

Bunched broccoli stored at 32°F with a relative humidity of 90-95 percent should have a 10-14 day shelf life. At higher temperatures the shelf life will decrease drastically. Storage at 50°F, for example, will reduce the shelf life to 5 days. Excessive storage time will cause yellowing and softening of the tissue and beads. Off-flavor and bad odor may also develop.

Broccoli should never be stored with ethylene sources such as ripening melons, avocados, bananas, apples, or pears. Exposure to ethylene will accelerate the yellowing of beads.

For more information see “Broccoli Production in California”, DANR Publication 7211 available from the Imperial County Cooperative Extension Office or on the Internet at http://anrcatalog.ucdavis.edu/specials.ihtml

BROCCOLI PROJECTED PRODUCTION COSTS 2002-2003

Hand labor at $9.25 per hour ($6.75 plus SS, unemployment insurance, transportation, workman's compensation, supervision, and fringe benefits.)

Yield--500 26-lb. cartons Field packed

OPERATION	Cost	Materials		Hand Labor		Cost
		Type	Cost	Hours	Dollars	Per acre
LAND PREPARATION						
Stubble disc	21.00					21.00
Subsoil 2nd gear	39.00					39.00
Disc 2x	12.50					25.00
Triplane 1x	11.25					11.25
Border,cross check & break borders	19.00					19.00
Flood irrigate		Water 1 ac/ft	16.00	1	9.25	25.25
Disc 2X	12.50					25.00
Triplane 1x	11.25					11.25
Fertilize, spread	7.00	500 lb. 11-52-0	58.75			65.75
List	15.00					15.00
TOTAL LAND PREPARATION						**257.50**
GROWING PERIOD						
Precision plant and white fly control	25.00	Seed 104M Admire @ 16 oz.	325.00 63.00			413.00
Spray herbicide	12.50	Dacthal	15.00			27.50
Sprinkler irrigate	160.00					160.00
Insect control via sprinkler		Insecticides	20.00			20.00
Cultivate 1x	14.00					14.00
Fertilize & furrow out 1x	13.00	80 lb. N @ .32	25.60			38.60
Water-run fertilizer		40 lb. N @ .32	12.80			12.80
Hand weed				4	37.00	37.00
Irrigate 8x		3 1/2 ac/ft	56.00	15	138.75	194.75
Insect control 3x	9.50	Insecticides	60.00			88.50
Disease control 2x	10.50	Fungicide	50.00			71.00
Chop stalks	13.75					13.75
TOTAL GROWING PERIOD COSTS						**1090.90**
GROWING PERIOD & LAND PREPARATION COSTS						1348.40
Land Rent (net acres)						200.00
Cash Overhead----		13% of preharvest costs & land rent				201.29
TOTAL PREHARVEST COSTS						**1749.69**
HARVEST COST - FIELD PACK						
Cut, pack, haul, cool and sell		500	26 lb cartons @ 4.50 /carton			2250.00
TOTAL OF ALL COSTS						**3999.69**

PROJECTED PROFIT OR LOSS PER ACRE

		Price/ 26-lb. carton (dollars)					
		5.00	6.00	7.00	8.00	9.00	**Break-even $/carton**
	300	-1600	-1300	-1000	-700	-400	10.33
Cartons	400	-1550	-1150	-750	-350	50	8.87
per	500	-1500	-1000	-500	0	500	8.00
acre	600	-1450	-850	-250	350	950	7.42
	700	-1400	-700	0	700	1400	7.00

* Harvest cost varies with the field conditions, the shipper and the market. Export quality costs more.