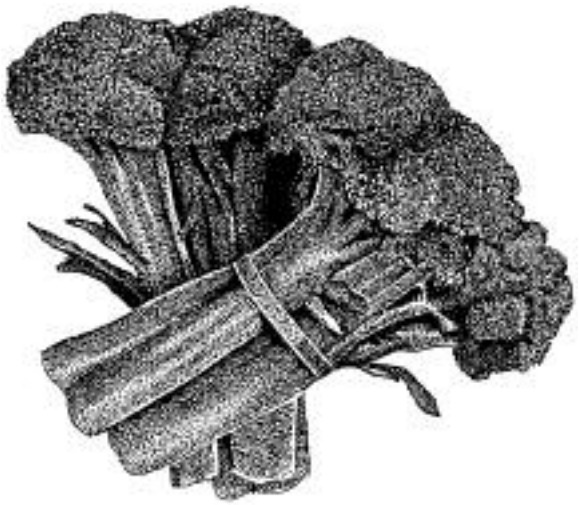
U.C. COOPERATIVE EXTENSION

SAMPLE COST TO ESTABLISH AND PRODUCE

BROCCOLI



IMPERIAL COUNTY – 2000

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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, seed companies, transplant producers, contract harvesters, fertilizer dealers, and equipment companies 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 dynamic and important vegetable industry in Imperial County.

The information presented herein allows one to get a "ballpark" idea of vegetable production costs and practices in the Imperial County. They do not reflect the exact values or practices of any grower or shipper, but are rather an amalgamation 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, 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, supplies, donations, utilities, transportation, 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. For crops that require additional labor or extra operations (i.e. leaf lettuce) we used 17% overhead to account for the additional expenses.

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, etc. Whenever possible we have given the costs of these operations per hour.

Not included in these production costs are expenses resulting from management fees, loans, supervision, or return on investments. The crop budgets also do not contain expenses encumbered for cleanup discing, road and ditch maintenance, perimeter weed control. If all the above items were taken into account, the budget may need to be increased by 7-15%.

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2000-2001 VEGETABLE CROPS PREVAILING RATES
IMPERIAL COUNTY

HEAVY TRACTOR WORK & LAND PREPARATION

OPERATION	$/ACRE
Plow	27.75
Subsoil, 2nd gear	38.75
Subsoil, 3rd gear	32.75
Landplane	12.00
Triplane	11.00
Chisel 15"	24.75
Wil-Rich chisel	14.75
Big Ox	21.25
Slip plow	39.00
Pull/disc borders	6.00
Make cross checks (taps)	6.00
Break border	5.75
Disc, stubble	21.75
Disc, regular	11.50
List 40" beds	13.50
Float	10.00
Disc, borders	11.25
Laser (acre)	34.00-38.00
Dump (scraper) borders	14.00

PLANTING, CULTIVATING & LIGHT TRACTOR WORK

	$/HR
Power mulch dry	23.00
Power mulch with herbicide	27.00
Shape 40" beds	9.50
Precision plant 40" beds	17.50
Cultivate 4-row 40" beds	13.00
Spike 40" beds	9.75
Spike and furrow 4-rows 40" beds	10.25
Furrow out 40-42" beds	9.75
Lilliston 40" beds	10.75
Lilliston 40" beds with/herbicides	14.50
Inject fertilizer and furrow out 40" beds	13.50
Fertilize dry and furrow out 40" beds	13.50
Broadcast dry fertilizer >300lb/a	7.00
Broadcast dry fertilizer <300lb/a	6.00
Ground spray 4-row	10.00
Ground spray 8-row	9.00
Layby herbicide	22.00

PREVAILING RATES BY THE HOUR

	$/HR
Motor grader	50.00
Backhoe	42.50
Water truck	39.00
Wheel tractor	32.00
Scraper	27.00
Versatile	53.00
D-6	46.50
D-8	65.00
Burn ditches	28.00
Buck ends of field	30.00
Pipe setting (2 men)	33.00
Laser	70.00
Work ends	40.00

IRRIGATION

Sprinkler irrigate	$125-160.00/acre
1 acre-foot of water	14.56
Sprinkler irrigate carrots	155.00

*Note – Cultural rates for specific crop operations listed on crop budgets.

FRESH MARKET BROCCOLI CULTURE 2000-2001

Annual acreage, yield, and value of fresh market broccoli in Imperial County, CA (1995-1999)

Year	Acres	Yield/Acre*	Gross Value/Acre
1999	13,603	428	$2,625
1998	9,589	541	$4,778
1997	7,613	522	$4,705
1996	7,092	385	$2,765
1995	5,926	495	$4,889

* 26 pound cartons

Source: Imperial County Agricultural Commissioners Reports 1995-1999

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 have 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 *Peto*; Legacy *Asgrow;* Green Belt *Sakata*; Everest *Novartis*; Marathon *Sakata;* Patriot *Sakata;* Signal *Novartis*; Liberty *Peto*; Triathlon *Sakata*; Ninja *Sakata;* and Major *Peto*

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 Most broccoli is direct seeded. Transplanting the crop is very expensive since there are roughly 48,000 plants/acre, however, a few fields are planted in this manner.

A Stanhay precision planter or an air planter is often used to sow the crop. Seed are placed _ to ¼ inch deep on 40-inch beds (two seed lines per bed). Spacing between seed lines is usually about 13 inches. Broccoli is typically planted to stand (no thinning). If a planting is thinned, seed should be planted roughly 2 to 3 inches apart then thinned to 6 to 7 inches in row.

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. Standard plant spacing within rows is 6 to 7 inches. However, depending upon the grower preference spacing can range from 4 to 8 inches.

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. Likewise, 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°.

"Cateye" (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 seed bed 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) 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 fertilizer user when 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.

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 caused by *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 sp. 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 and sometimes three times depending upon the market. 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 "cateye", broken florets, dirt, debris, and irregular bead size

Normally, bunches are comprised of 2-4 heads 8 inches in 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 cartons containing 14 or 18 bunches.

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 an 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.

If bunched broccoli is stored at 32°F with a relative humidity of 90-95 percent, it 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 2000-2001

Hand labor at $7.75per hour ($5.75 plus SS,unemployment insurance, and transportation, 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	21.75					21.75
Subsoil	38.75					38.75
Disc 2x	11.50					23.00
Landplane 2x	12.00					24.00
Border,cross check & break borders	17.75					17.75
Flood irrigate		Water 1 ac/ft	14.56	1	7.75	22.31
Disc 1X	11.50					11.50
Triplane 1x	11.00					11.00
Fertilize	8.00	500 lb. 11-52-0	63.75			71.75
List	13.50					13.50
TOTAL LAND PREPARATION						**255.31**
GROWING PERIOD						
Preplant whitefly control	10.00	Admire @ 16 oz.	63.00			73.00
Precision plant	17.50	Seed 104M	312.00			329.50
Sprinkler irrigate	145.00					145.00
Preimergence insect control			30.00			30.00
Spray herbicide	12.00	Prefar	31.00			43.00
Thin				8	62.00	62.00
Cultivate 1x	13.00					13.00
Fertilize & furrow out 1x	13.50	80 lb. N @ .35	28.00			41.50
Water-run fertilizer		40 lb. N @ .35	14.00			14.00
Hand weed				4	31.00	31.00
Irrigate 8x		3 1/2 ac/ft	50.96	8	62.00	112.96
Insect control 2x	9.50	Insecticides	60.00			79.00
Disease control 1x	10.50	Fungicide	25.00			35.50
Chop stalks	12.00					12.00
TOTAL GROWING PERIOD COSTS						**1021.46**
GROWING PERIOD & LAND PREPARATION COSTS						1276.77
Land Rent (net acres)						200.00
Cash Overhead----		13% of preharvest costs & land rent				191.98
TOTAL PREHARVEST COSTS						**1668.75**
HARVEST COST - FIELD PACK						
Cut, pack, haul, cool and sell		500	26 lb cartons @	4.25 /carton		2125.00
TOTAL OF ALL COSTS						**3793.75**

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	-1444	-1144	-844	-544	-244	9.81
Cartons	400	-1369	-969	-569	-169	231	8.42
per	500	-1294	-794	-294	206	706	7.59
acre	600	-1219	-619	-19	581	1181	7.03
	700	-1144	-444	256	956	1656	6.63

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