

UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

**SAMPLE COSTS TO ESTABLISH AND PRODUCE BLUEBERRIES IN SAN
LUIS OBISPO, SANTA BARBARA, AND VENTURA COUNTIES,
CONVENTIONAL PRODUCTION, 2007**



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INTRODUCTION

Blueberry production in the United States began with collection of wild berries growing in the Eastern and Northeastern states. Then during the early to mid 1900s, cultivated blueberry production began with the breeding of northern highbush type blueberries, developed in the cooler regions of the United States including New Jersey, Massachusetts, Maine, Michigan and eventually moving west into Oregon, and Washington. In the mid 1970's, a cooperative plant breeding effort between the USDA and several universities in the southeastern US - including the University of Florida - led to the release of the first low-chill requirement "southern" highbush blueberry for early season production in the southeast. In the late 1990s, efforts to grow blueberries began in California based on these southern highbush types and blueberry plantings have continued to expand since that time (Jimenez, et al, 2005). As of 2007, it is estimated that over 4000 acres of blueberries are planted in California.

Sample costs to establish and produce blueberries in San Luis Obispo, Santa Barbara, and Ventura Counties are presented in this study. Operations described are based on production practices considered typical for the area and may not apply to every situation. The study is intended as a guide for making production decisions, estimating potential returns, preparing budgets and evaluating production loans. A blank "Your Costs" column in some of the cost tables is provided for entering and comparing individual farm costs with ours.

The hypothetical farm operations (production practices) and cost calculations are described in the assumptions section. For additional information or explanations of the assumptions and calculations used in this study, please contact Eta Takele, the Area Farm Management advisor, or Ben Faber and Mark Gaskell, Farm Advisors in Ventura and Santa Barbara and San Luis Obispo counties, respectively. This cost study can be accessed from the following websites: the Farm Management Website of the University of California Cooperative Extension Program for Southern California at: <http://groups.ucanr.org/farmgt>, the University of California Hansen Trust website at: <http://groups.ucanr.org/Hansen/index.cfm> and the University of California, Department of Agricultural and Resource Economics websites at Davis at: <http://coststudies.ucdavis.edu>.

ASSUMPTIONS: CULTURAL PRACTICES AND COST CALCULATIONS

The discussion in this section includes production practices (inputs, application rates and time of application and methods). Input prices, contract fees and service expenses that are not mentioned in the text are included in Table 4. Prices and costs are for the year 2007.

The use of trade names in this report does not constitute an endorsement or recommendation by the University of California nor is any criticism implied by omission of other similar products.

Farm Size and Crop Characteristics: This study is based on 10 acres of blueberry production. Blueberries are a perennial crop with a production life of over 20 years. In California, many cultivars are still under investigation for their adaptability and suitability to the region. Therefore, growers may be switching to a new cultivar even before the full productive life of the planting is reached. In this study, we are assuming a 23 year life (i.e. three years of establishment and 20 years production period). It should also be noted that the time of establishment may be variable depending upon the size of the transplants at planting, the suitability of the growing area to the blueberry plant and the effectiveness of the cultural practices.

Land Preparation: Many blueberry plantings in the coastal southern California production areas are established in what had been strawberry or vegetable production fields. However, for this study, the blueberry planting is based on open or new land (not previously cultivated). Therefore operations and costs of land preparation, irrigation installations and/ or fertility management could be higher than previously cultivated land.

Land preparation operations include first clearing off weeds, bushes, roots and plants followed by uniform incorporation of woodwaste and preplant fertilizer and bed preparation. Growers usually use contract operators to get land preparation done (Table 1). The field is then marked with flags where holes are dug for planting; an operation considered taking one minute per plant.

Wood Waste Application: During establishment years, a coarse, wood waste is applied to promote growth of the young blueberry plants. On heavier, slow to drain soils, wood waste may also be incorporated into beds prior to planting. Application of wood waste may range from 4 to 6 inches deep and covers a 4 feet band centered on the plant row. The wood waste has to be replenished regularly as it will deteriorate over time. Deteriorated wood waste adds organic matter to the soil and creates favorable environment for root growth, however, root damage can occur if it is not replenished as needed. In this study, it is assumed that 50 tons of wood waste per acre will be applied during the first year, and replenished with about 20 tons per acre every two years. In this study, we assume that the farmer needs around 5 man-hours per acre for application of wood waste during the first year and 2 man-hours per acre every two years. On very sandy soil, wood waste is applied on the surface. It does not need to be incorporated.

Acidification: The blueberry plant is acid-loving with the optimum soil pH level in the 4.0 to 5.0 range. It is important to analyze soil samples to determine the initial pH of the soil and the level of sulfur needed for acidification. In the coastal California region, adjustments are usually necessary since most soils have pH levels between 6.7 and 8.0. Adjustments for blueberry production are made using pelletized sulfur application ranging from 3,000 pounds per acre to 7,000 pounds per acre. For this study, we used sulfur application at 5,000 pounds per acre before planting. Labor cost for sulfur application is estimated at \$120 per acre. Also, planting in sphagnum peat will also lower soil pH, thus helping adjust the acid environment for plant establishment.

Soil pH monitoring is important. Soil pH above 5.0 will cause plants to grow very slowly and remain weak. Plants that grow on land with an improper pH level may become yellow, and grow poorly as a result of iron deficiency or chlorosis and it should be corrected with an iron chelate application.

Beginning the second year, soil pH can be adjusted using the application of sulfur at a rate of 200 pounds per acre per year. In the Coastal regions, the application will be sometime in October. Sulfuric acid or urea sulfuric acid such as Nphuric or similar product should be injected into the irrigation water to lower the pH to 5 and this will help acidify the soil as well. The injection rate will vary with the quality of the irrigation water but for this study it is assumed that urea sulfuric acid is applied at a rate that will require approximately 145 gallons per acre per year.

Iron chelate fertilizers may be applied as a drench, injected into the irrigation system (using injection equipment) or applied as a foliar spray. Iron helps plant growth even when the pH has not fallen to the optimum range of 4.5 to 5.0. The fertilizer use of both urea sulfuric acid and iron chelate is discussed below.

Planting: Bushes used for planting may range from 12 to 18 months old. According to field trial results, a number of Southern Highbush cultivars are well adapted to Southern California. Among them Emerald, Jewel, Star, Sapphire, Sharpblue, and Misty are the most popular cultivars in coastal California. However, distribution of some patented blueberry cultivars may be limited to specific nurseries; therefore availability may be an issue. Farmers must check with the nurseries for plant availability before they decide to plant.

Plant spacing may vary among growers. In this study, we assume plant spacing is 2.5 feet between plants within a row and 10 feet between rows allowing 1,750 plants per acre. The cost of plants is approximated at \$3.50 each and planting in the coastal region can occur at any time. For this study, planting is in the month of June. Some of the bushes (~2%) may not survive in the first year; therefore have to be replanted in the second year.

Most growers use contract or hired labor to perform the planting operation. At planting, sphagnum peat moss for lowering pH is incorporated into each hole at a rate of 1 bale for 40 bushes. Incorporation of the peat moss and planting each is assumed to take one minute per bush.

Pruning: Pruning is required to maintain the vigor and productivity of blueberry plants including making the farm accessible for disease and insect inspection and management, as well as providing easy access for harvest by removing low-fruiting branches or canes. For hand harvest, bushes are kept within easy picking height. Annual pruning is essential for consistent production of high quality fruit.

Pruning immediately after harvest has the advantage of allowing rapid shoot re-growth and flower bud initiation before the plant enters into the slow growth period of winter months. Studies have shown that pruning following transplanting stimulates new vegetative growth. In the first year, pruning involves primarily stripping off flowers and fruit. The cost of pruning in the first year is estimated at \$250 per acre. Beginning the second year, hand pruning is performed every year and is estimated to take 0.5 minutes per plant.

Fertilization: Table A provides the approximate amount of fertilizer requirement for conventional blueberry production. A pre-plant fertilizer (15-15-15) will be broadcast and incorporated prior to bedding at a rate of 400 pounds per acre. Blueberry Nitrogen (N) fertilizer requirements are 30 pounds per month from June to November and then 15 pounds per month

from December to May. Commonly two fertilizer types are used as sources of N namely urea sulfuric acid and ammonium sulfate. Urea sulfuric acid (15% nitrogen, 16% sulfur, and 49% sulfuric acid) as a source of N and also to lower the water pH to 5.0 is applied every week from February to November at a rate of 1,645 pounds per acre per year with irrigation water. In addition, ammonium sulfate (21-0-0) is applied annually at a rate of 115 pounds per acre per year.

Iron chelate application can be done either as a foliar spray or injected into the irrigation system. Iron chelate as discussed above will relieve plants from iron deficiency related to soils with pH above 5.3. In this analysis, iron chelate is applied using the irrigation system; two times (June and July) for the first year and four times (April, May, June and July) per year from the second year on. Iron Chelate is applied at the rate of five pounds per acre per application.

Table A. Fertilizer Application Rates in Blueberry Production in San Luis Obispo, Santa Barbara, and Ventura Counties

Year	Pre-Plant (15-15-15) Pounds Per Acre	Urea Sulfuric Acid (15-0-0) Pounds Per Acre	Nitrogen from 15-0-0 Pounds Per Acre	Ammonium Sulfate (21-0-0) Pounds Per Acre	Nitrogen from (21-0-0) Pounds Per Acre	Iron Chelate Pounds Per Acre
1	400	822.5	123.5	57.5	11.5	10
2		1645	247	115	23	20
3		1645	247	115	23	20
Production		1645	247	115	23	20

Blueberry plants need a consistent soil moisture level for a fertilizer program to be effective. The plants are shallow rooted therefore to ensure consistent soil moisture; small amounts of frequent irrigation must be applied.

Soil and leaf analyses are done annually to determine the nutrient levels. Soil analysis must begin in the first year of planting while leaf analysis begins in the third year. N, Phosphorous (P), Potassium (K), Zinc (Zn) and Boron (B) levels will be analyzed from one sample. Soil and leaf laboratory analyses are approximated to cost \$25 and \$20 per acre per year, respectively. Irrigation water analysis should also be done periodically to determine the presence of nitrate, salinity, pH level, chloride and sodium in well water.

Irrigation: Growers in San Luis Obispo, Santa Barbara, and Ventura Counties use both district water and on-site wells for irrigation. District water may be delivered, stored and pumped from a reservoir through a filtration system. Water costs are calculated based upon the use of both well and district sources. For this study, based on growers' feedback, water cost is estimated at \$22.10 per acre-inch.

Water application is estimated at 24 acre-inches per acre per year during both the establishment and the production period. Irrigation is applied weekly for about 44 weeks per year from February to November (except for the first year, the number of irrigation applications will be 26

from planting in June to November). No assumption is made about effective rainfall, evapotranspiration or runoff. Information on evapotranspiration and rainfall if needed are available from various sources. For Ventura County, sources include Fox Canyon Groundwater Management Agency (<http://www.foxcanyongma.org>) and the California Irrigation Management Information System (CIMIS) at www.cimis.water.ca.gov/cimis.

Labor to irrigate, monitor systems and check fields is estimated to take about 15 minutes per irrigation or 11 hours for the 44 annual irrigations.

Pest Management: Blueberry growers should check their field continuously and control fungal and bacterial diseases as well as arthropods and vertebrates in order to ensure good productivity. One of the important elements of pest control in blueberry production is using appropriate cultural practices. For information and pesticide use permits, contact the local county agricultural commissioner's office or a *Pest Control Adviser (PCA)*. Also for information on cultural control of blueberry pests, consult the Integrated Pest Management (IPM) guidelines that are applicable to other fruit crops or contact the local University of California Cooperative Extension Farm Advisors. Written recommendations made by licensed pest control advisors are required for use of many pesticides. PCAs can also be hired to monitor fields for pests and recommend nutrition. Following are descriptions of disease and pest control practices for conventional blueberry production.

Weeds: Weed control begins in the second year and includes mowing three times a year, hand weeding twice a year which takes approximately 160 hours per acre per year. Roundup (glyphosate) spray will be applied at a rate of 1 gallon per acre to control perennial weed invasion.

Diseases: Fruit and foliar diseases can be controlled with fungicides and maintaining good cultural practices. Stem and root diseases are more difficult to control. Selection of disease free plant stocks, removing and discarding of infected plant parts, raising beds with wood waste, and selecting a well drained ground will help to reduce the incident and severity of root and stem diseases.

Fungal diseases: Fungal diseases in blueberry production include Botrytis blight (*Botrytis cinerea*) and Mummy berry (*Monilinia vaccinii-corymbosi*) which affect the stem of the plant, as well as the fruit and the flower. They can be controlled with an application of Rovral twice a year starting from the second year at approximately 1 pound per acre per application. Phytophthora can be a problem in poorly drained soils; which can be avoided with selection of site that is possibly free of Phytophthora and with good land preparation.

Bacterial disease: Canker (*Pseudomonas* spp.) is a common bacterial disease that affects the stem and leaf of the blueberry plant. It can be controlled by pruning out all affected parts of the plant as well as with an annual application of Kocide (Copper hydroxide) at a rate of 6 pounds per acre beginning the second year. Table B provides a list of selected chemicals and amounts of application typically used in conventional blueberry production.

Table B. Pesticide Application Rates in Blueberry Production in San Luis Obispo, Santa Barbara, and Ventura Counties

Year	Roundup Gallon Per Acre	Rovral Pounds Per Acre	Kocide Pounds Per Acre
1			
2	1	2	6
3	1	2	6
Production	1	2	6

Bird control: One of the most important challenges of blueberry production is the control of fruit damage by birds. Each year about 10 to nearly 100 percent of the blueberry crop can be lost to bird destruction. Netting is the only strategy that will completely reduce bird damage, though it is expensive and difficult to move around during cultural practices. In this study, it is assumed that growers will install polyethylene netting material during the third year. In addition to netting, at least one hour per week for five months (during harvesting) is needed for monitoring and maintaining the bird control system.

Bird netting replacement may be necessary every five years. Table C presents the cost breakdown of the bird control system for blueberry production.

Table C. Bird Control Materials and Installation Costs for Blueberry Production in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007

Items	Amount	Units	Price (\$ Per Unit)	Total Cost (\$)
Net	23000	ft	0.1	2300
Post	115	each	10	1150
Wire	5000	ft	0.1	500
Materials, Cement and Other				250
Labor for Installation	10	hr	13.3	133
Total Costs for One Acre				4333
Total Costs for Ten Acres				43330

Pollination: Cross pollination improves blueberry yield. Planting different cultivars in alternate rows can facilitate cross pollination. Planting the same cultivar within a row is, however, advantageous for ease of harvesting, so it is recommended not to mix varieties within the same row. Two beehives per acre will be placed in the field beginning the second year. A beehive can be rented at approximately \$125 a year.

Frost Protection: Sprinkler irrigation is used for frost protection of fruits especially that are early in the season from rare periods of frost damage along the Coast. This additional investment is needed to protect early season fruits with high market prices. The system requires approximately 50 sprinkler heads, capable of delivering 3,000 gallons per hour per acre. An automatic temperature sensor and irrigation pump starter unit may also be needed or else manual overnight temperatures monitoring will be required. The estimated cost for frost protection system with an automatic controller ranges from \$1,500 – \$2,000 per acre. In this study, the cost of the frost protection is included in the irrigation system.

Harvesting and Marketing: We assumed that the berry bushes at planting are already one year old or more. Hence fruit bearing may start at 6 months after planting. Fruit is picked into buckets mostly using hired or contract labor. Some blueberry varieties begin to ripen by mid-December and usually finished by mid-June. Full ripening takes several days (3-5) after they turn blue. In this study, we assume that 10% of the crop is harvested and marketed in January, 15% in February, 20% in March, 40 % in April and 15% in May. Picking costs are estimated at \$0.70 per pound and packing which includes pallet, clam shells, boxes is estimated at \$1.50 per pound. Also \$0.65 per pound is assumed for cooling, loading and quality control. Early season coastal blueberry growers typically move the fruit directly to market without additional storage fees. Marketing and brokerage fees are estimated at \$0.65 per pound (10% of blueberry prices).

Yield: Yield estimates include 1 pound per bush in the second year, 4 pounds per bush in the third and an average of 8 pounds per bush beginning the 4th year.

Table D. Estimated Annual Yield of Blueberries in San Luis Obispo, Santa Barbara, and Ventura Counties

Year	Number of Fruit Bearing Bushes Per Acre	Average Yield Pounds Per Bush	Total Yield Pounds Per Acre
2	1715	1	1715
3	1750	4	7000
Production	1750	8	14000

Labor Costs: Wage rates for both the owner and hired labor are estimated at \$13.15 per hour for machine operator and \$11.80 per hour for non-machine labor. Labor wages include payroll taxes, workman compensation and other overhead costs associated with employment benefits.

Equipment Operating Costs: Machinery repair costs are calculated using purchase prices, annual hours of use, total hours of life, and repair coefficients formulated by the American Society of Agricultural Engineers (ASAE). Fuel and lubrication costs are also determined by ASAE equations based on maximum PTO horsepower and fuel type. According to the data from the USDA-NASS, prices for on-farm delivery of diesel and gasoline are \$2.30 and \$2.80 per gallon, respectively. The fuel, lube, and repair costs per acre for each operation are determined by multiplying the hourly operating cost of the equipments by the number of hours per acre needed to perform the operation. Tractor and ATV time is 10% higher than implement time for a given operation to account for setup, travel and down time. Formulas for calculating equipment operating costs can be referenced from many farm management books including the one we frequently use for our studies (Boelje, Michael D., and Vernon R. Eidman. 1984. *Farm Management*, John Wiley and Sons. New York, New York).

Cash Overhead Costs: Cash overhead costs consist of all cash expenses that are incurred in the blueberry farm but are not accounted for in the production practices. These costs include interest on operating capital, property taxes, office expenses, liability and property insurances, sanitation services, equipment repairs, and management.

Interest on Operating Capital: The cost of borrowing or the opportunity cost (interest on operating capital) for money used in blueberry production is charged at 10% nominal interest rate on all operating expenses. Nominal interest rate is the current short term charge set by financial institutions for operating loans.

Property Taxes: Real estate property taxes depend on the value of the property and local zoning ordinances. We calculated property taxes at 1.0% (the rate most counties commonly charge) of the value (price) of land. For non-real estate properties, property taxes are estimated at 1.00% of the average values of the properties. Average values equal the price of the investment plus salvage value divided by two. Property taxes are then divided by the number of acres to obtain the per acre costs.

Property Insurance: Property loss coverage insurance is charged annually at 0.70% of the average value of the properties over their useful life. Property insurances are also divided by the number of acres to obtain the per acre costs.

Liability Insurance: Liability insurance for accidents on the farm varies by size of farm. The cost of liability insurance for a 10 acre farm is approximately \$437 per year (\$44 per acre per year).

Field Sanitation: Regulations require one toilet and hand washing facility for each 20 employees of each sex, located within a quarter mile walk, or if not feasible, at the closest point of vehicular access. As an alternative to providing the required toilet and hand washing facilities themselves, employers may transport employees conducting hand-labor operations to toilet and hand washing facilities (refer to specifications Cal/OSHA Field Sanitation Standard, Section 3457, Title 8, California Code of Regulations).

For this study, one double mounted toilet facility is considered sufficient for the 10 acres for use throughout the year. The rent for the facility is approximated at \$270 per acre per year.

Office Expense: Expenses for office rent, supplies, telephone, fax, internet, accounting, legal fees, utilities and miscellaneous administrative expenses are estimated at \$350 per acre per year.

Investment Repairs: Annual repair and maintenance costs for farm buildings, tools and reservoir are calculated at 2% of the price (value) of the investment. For irrigation system and bird control, annual maintenance and repair costs are calculated at 5% of the cost of the system.

Management/Supervisor Salaries: Management charges are not included in this study. We suggest that growers divide the returns after all costs between management and profit as they see fit.

Non-Cash Overhead Costs: Non-cash overhead costs, also referred to as ownership or fixed costs of farm assets including equipments, farm buildings, irrigation system, and farm tools are calculated using the capital recovery method. This method captures the combined cost of depreciation and interest on capital investment.

The capital recovery method of calculating depreciation and interest on investment is more complex than other methods, but more accurately represents the annual costs of ownership. It is similar to the discounted annual payment on a loan for the investment with the down payment equal to the salvage value. The formula for calculating the annual capital recovery is:

$[(\text{Purchase Price} - \text{Salvage Value}) \times \text{Capital Recovery Factor}] + (\text{Salvage Value} \times \text{Interest Rate}).$

Where:

Salvage Value: The remaining value of machinery and equipment at the end of their useful life is assumed to be 10% of the purchase price. Other investments including irrigation systems, buildings, and miscellaneous equipments (fuel tanks and pumps) are assumed to depreciate fully with no remaining values.

Capital Recovery Factor: The discounted present value of \$1, the annual capital recovery multiplier.

Interest Rate: The ten year average long-run rate of return of agricultural assets to current income (7.25%--USDA-ERS-Economic Research Services data).

Following are the descriptions of the farm investments used in blueberry production.

Equipment: The farm complement is assumed to include both new and old equipment and machinery with approximate current value of 60% of new prices. Capital recovery costs for machinery and equipment used in this study are shown in Table 6.

Irrigation and Frost Protection System: The irrigation system is assumed to include an on-site reservoir for storing water that is supplied by the districts; pumps (a new 15 horsepower booster pump lifting water to about 20-feet); a filtration station; drip irrigation lines (installed before planting); a fertilizer injector (installed at planting), and sprinklers. The drip lines are used for irrigating the crop and sprinklers are used when irrigation is needed for frost protection. The cost to establish the irrigation system including the frost protection system is estimated at \$3,500 per acre (\$35,000, for a 10 acre farm). Frost protection alone could cost \$1,500 to \$2,000 per acre. In addition, an acid injector may be installed to maintain the acid condition of irrigation water unless the fertilizer injection system is built to serve for acid injection as well. The irrigation system has a life of 23 years.

Building: It is assumed that blueberry production shares facilities such as buildings, fuel tanks and tools with other production projects. The farm shed is assumed to be 1,500 square feet of metal buildings built on cement slab.

Shop Tools: Shop tools used in the farm for blueberry production include pruning tools, picking containers, pH measurement kit and other miscellaneous farm tools. Also a 100-gallon fuel tank is considered to service the farm. The fuel tank must be situated on a cement containment pad built to meet federal, state, and county regulations.

Land Rent: In many cases, especially in California the value of land is influenced by a rapid urban development in which case the price of land is driven not by its agricultural use but by the speculative value of its future use. Some cost studies exclude the land rent in which case the bottom line figure of net returns can be referred as returns to management and land. Growers may choose to divide this figure between management and land rent as they see fit.

Land rent is estimated at 7.25% opportunity cost (that is equivalent to a ten year average long-run rate of return of agricultural assets to current income) times \$35,000 per acre value of land (which is approximated as an average for San Luis Obispo, Santa Barbara, and Ventura counties).

Establishment Cost: The cumulative net cash, the sum of all cash costs less returns over the three years, \$6,807 per acre (68,070 for 10 acres) is called the establishment/development costs. Establishment cost is amortized over 20 years (the expected useful life of the bushes) to get the annual opportunity cost of the investment plus depreciation of the bushes.

Crop Returns: The fruit is sold through wholesale markets. A grower price of \$6.55 per pound is approximated as the weighted average of the Los Angeles Terminal Market for imported blueberries from January to May for the 2005 to 2007 seasons (Table E). The gross income estimates during the establishment and production years is given in Table F below.

Crop prices and grower returns may, however, differ depending on the variety they produce, the time of selling and the supply and demand condition of the market. Therefore, returns using various scenarios of prices and yield combinations are provided in Table 8. Growers may choose the returns that best reflect their specific situation. Crop values of the establishment years are used to offset costs.

Table E. Los Angeles Terminal Market Prices for Imported Blueberries (January–May, 2005-2007), Percentage of Crop Harvested and Marketed, and Weighted Average Price

Month	Price (\$/lb)			Average Price (\$/lb)	Percentage Share of Crop Marketed	Weighted Average Price (\$/lb)
	2005	2006	2007			
January	4.48	3.96	4.85	4.43	10	0.44
February	4.07	5.83	4.83	4.91	15	0.74
March	5.27	6.77	6.09	6.04	20	1.21
April	10.54	7.38	6.66	8.19	40	3.28
May	6.40	4.12	6.92	5.81	15	0.87
Total					100	≈ 6.55

Table F. Estimated Annual Yield and Gross Income of Blueberry Production in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007

Year	Yield Pounds Per Acre	Gross Income (\$ Per Acre)
2	1,715	11,233
3	7,000	45,850
Production	14,000	91700

SUMMARY

Conventional blueberry bush establishment and production costs in this study are based on the most common or typical operations expressed by growers in San Luis Obispo, Santa Barbara, and Ventura Counties, but can vary depending upon management and cultural practices.

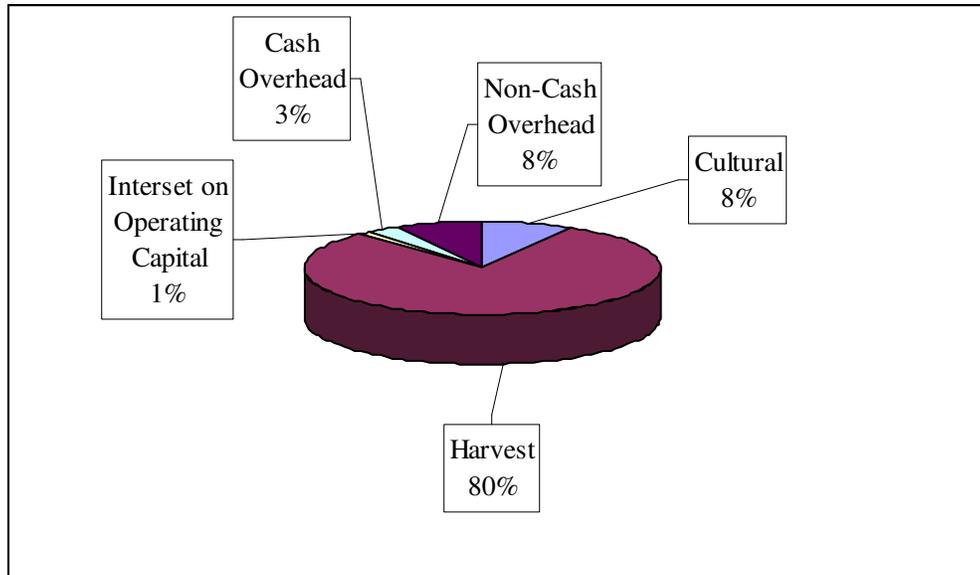
Our estimate of the total accumulated net cash cost during the three years period of blueberry bushes establishment is \$6,807 per acre (Table 1). The annual production cost including harvesting (assuming 14,000 pounds per acre yield) is \$61,665 per acre or \$4.40 per pound (Tables 2, 3 and 4). Table 2 shows costs by category, Table 3 by type of operation and Table 4 by type of production input. Due to rounding, the totals may not be exactly the same in all tables.

The proportion of production costs by category is shown in the pie graph below. It includes about 8% in cultural costs (such as pruning, weed control, pest control, fertilization, and irrigation), 80% harvesting (picking, packing, cooling and handling, and marketing and brokerage fees). Cash overhead costs including liability insurance, soil analysis, leaf analysis, sanitation fee, office expenses, property taxes, property insurance and investment repairs are estimated to account for about 3%; non-cash overhead or annual ownership costs estimates of land rent, equipments, buildings, tools, bird control, and irrigation system account for 8% and interest on operating capital for 1%.

PROFIT ANALYSIS

Profitability is measured using the unit cost of production (or break-even price) as well as the gross and economic margins. The unit cost of production compared with the market prices provides the margin of profit. The unit cost of production is calculated as the total cost per acre divided by yield per acre. Gross margin (or returns above cash costs) is what growers often refer to as profit if there is no debt on the farming operation. It approximates the return to management and investment. If we deduct depreciation, it also approximates the taxable income of the investment. Gross margin is calculated as gross returns (price times yield) minus cash costs of production. Economic profit or the net returns above all total costs including management can be zero or positive. A zero economic profit should not be alarming if all costs including the owners' labor and management are included in the production cost.

Figure 1. Proportion of Blueberry Production Costs in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007



The break-even price using our yield assumption of 14,000 pounds per acre at maturity is \$4.40 per pound. The gross margin estimate using the same yield level and an average price of \$6.55 per pound is \$34,856 per acre. In this study we did not calculate the economic returns because we did not include management charges. Information was not available for it.

Crop yield and prices received by growers may vary. To accommodate such variation, we provided unit costs of production (break-even prices), gross margins and returns to management and profit at various price and yield levels (Table 8). The table included lower and higher than the average price and yield.

ACKNOWLEDGEMENTS

The authors thank the growers in the San Luis Obispo, Santa Barbara, and Ventura Counties of the Coastal Region of southern California who have been the main source of information for this study. We also thank those who participated in the review of this study and appreciate the secondary sources (research papers) that enhanced our understanding of the conventional blueberry production.

Table 1. Sample Costs per Acre to Establish Blueberries in San Luis Obispo, Santa Barbara, and Ventura Counties , 2007

Year	Cost per Acre (\$)		
	1st	2nd	3rd
OPERATIONS			
LAND PREPARATION: (Contract)			
Brush Removal	450		
Ground Preparation	350		
Rip Field	375		
Bed Preparation	500		
TOTAL LAND PREPARATION COSTS	1675		
PRE PLANT:			
Flag Field	438		
Acidification	1220		
Dig holes	438		
Fertilizer (15-15-15)	100		
TOTAL PREPLANT COSTS	2196		
PLANTING: (Contract, Labor, Material, Equipment Operating Costs)			
Plants	6524	140	
Peat Moss	829	18	
TOTAL PLANTING COSTS	7353	158	
CULTURAL: (Contract, Labor, Material, Equipment Operating Costs)			
Irrigate	401	759	759
Weed control		1940	1940
Mow Strip		24	24
Fungicide		65	65
Bacterial Disease		46	46
Pruning (0.5 min/plant 2nd year on)	250	172	172
Acidification-Sulfur		44	44
Wood Waste	636	127	127
Fertilize (Urea Sulfuric Acid)	432	844	844
Fertilize (Ammonium Sulfate)	56	111	111
Fertilize (Iron Chelate)	107	214	214
Pollination		250	250
Bird Control			502
TOTAL CULTURAL COSTS	1882	4596	5098
HARVEST: (Contract)			
Picking (\$0.70 per Pound)		1201	4900
Packing (\$1.50 per Pound)		2572	10500
Cooling and Handling (\$0.65 per Pound)		1115	4550
Marketing and Brokerage Fees (\$0.65 per Pound)		1115	4550
TOTAL HARVEST COSTS		6003	24500
Interest on Operating Capital @ 10%	849	354	520
TOTAL OPERATING COSTS	13955	11111	30118
CASH OVERHEAD:			
Liability Insurance	44	44	44
Office Expenses	350	350	350
Interest- Cash Overhead Costs	79	79	93
Interest- Establishment Net Cash Costs		1562	1872
Soil Analysis	25	25	25
Leaf Analysis			20
Field Sanitation	270	270	270
Property Taxes	393	394	415
Property Insurance	275	275	291
Investment Repairs	225	225	442
TOTAL CASH OVERHEAD COSTS	1661	3224	3822
TOTAL ALL CASH COSTS	15616	14335	33940
INCOME FROM PRODUCTION	0	11233	45850
NET CASH COSTS FOR THE YEAR	15616	3102	-11910
ACCUMULATED NET CASH COSTS	15616	18718	6807
NON-CASH OVERHEAD (CAPITAL RECOVERY):			
Irrigation System (Including Frost Protection)	317	317	317
Land Rent	2537	2537	2537
Shop Building	181	181	181
Shop Tools	44	44	44
Bird Control-Net			565
Bird Control-Rest of Material (Post, Wire, Cement and Labor)			191
Equipment	290	331	331
TOTAL NON-CASH OVERHEAD COSTS	3369	3410	4166
TOTAL ALL COSTS	18985	17745	38106
RETURNS/INCOME FROM PRODUCTION	0	11233	45850
TOTAL NET COSTS FOR THE YEAR	18985	6512	-7744
TOTAL ACCUMULATED NET COST	18985	25497	17752

Table 2. Costs per Acre by Category to Produce Blueberries in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007

OPERATION	Operation	Costs per Acre(\$)					Total Cost	Your Cost
	Time (Hrs/Acre)	Labor Cost	Fuel, Lube & Repairs	Material Cost	Custom or Rent			
CULTURAL: (Contract, Labor, Material, Equipment Operating Costs)								
Irrigate - 44 weeks/year for 15 minutes/irrigation	11	174	55	530	0	759		
Weed Control-Hand weeding for 160hr &Roundup	160.5	1896	0	43	0	1939		
Mow Strip -3X	1.5	24	0	0	0	24		
Fungicide 2X- Rovral @ 1lb/time	1.0	16	1	48	0	65		
Bacterial Disease -1X- Kocide @6lbs/acre	0.5	8	0	37	0	45		
Pruning - 0.5 minute/bush	14.6	172	0	0	0	172		
Acidification -@200 lbs Sulfur/acre	0	0	0	44	0	44		
Wood Waste - 20 tons wood waste/ 2 year & labor	1	16	12	100	0	128		
Fertilize - Urea Sulfuric Acid @ 1,645 lbs/acre	8.8	104	0	740	0	844		
Fertilize - Ammonium Sulfate @ 115 lbs/acre	6	95	5	12	0	112		
Fertilize - Iron Chelate @5 lbs for each month 4X	8	94	0	120	0	214		
Pollination - Rent@ \$125/hive & 2hives/acre	0	0	0	0	250	250		
Bird Control - labor for 24 hours/acre & ATV operating cost	24	379	124	0	0	503		
TOTAL CULTURAL COSTS	237	2978	197	1674	250	5099		
HARVEST:								
Picking - \$0.70/lb	0	0	0	0	9800	9800		
Packing - \$1.50/lb	0	0	0	0	21000	21000		
Cooling and Handling (\$0.65 per Pound)	0	0	0	0	9100	9100		
Marketing and Brokerage Fees (10% of price or \$0.65/lb)	0	0	0	0	9100	9100		
TOTAL HARVEST COSTS	0	0	0	0	49000	49000		
Interest on Operating Capital @10%						735		
TOTAL OPERATING COSTS		2978	197	1674	49250	54834		
CASH OVERHEAD:								
Liability Insurance						44		
Office Expenses						350		
Interest- Cash Overheads						96		
Leaf Analysis						20		
Soil Analysis						25		
Field Sanitation						270		
Property Taxes						449		
Property Insurance						314		
Investment Repairs						442		
TOTAL CASH OVERHEAD COSTS						2010		
TOTAL CASH COSTS						56844		
NON-CASH OVERHEAD:								
		Unit Price \$ Per Acre		Capital Recovery Per Year (\$)				
Irrigation System		3500		317		317		
Land		35000		2537		2537		
Shop Building		2000		181		181		
Shop Tools		500		44		44		
Establishment Costs- Accumulated Net Cash Cost		6807		655		655		
Bird Control-Net		2300		565		565		
Bird Control -Rest of Material (Post, Wire, Cement and Labor)		2033		191		191		
Equipment		2421		331		331		
TOTAL NON-CASH OVERHEAD COSTS						4821		
TOTAL ALL COSTS						61665		

Table 3. Costs per Acre by Operation to Produce Blueberries in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007

OPERATION	Operation Time (Hours Per Acre)	Costs Per Acre (\$)							Operating Interest Costs	Total Costs
		Labor Costs	Material Costs	Custom or Rent Costs	Equipment					
					Capital Recovery Costs	Cash	Operating (Fuel, Tax & Insurance Costs			
						Overhead		Lubricant & Repair Costs		
CULTURAL:										
Irrigate	11	174	530	0	15	1	55	40	815	
Weed Control	161	1896	43	0	2	0	0	144	2085	
Mow Strip	2	24	0	0	41	2	0	1	68	
Fungicide	1	16	48	0	3	0	1	2	70	
Bacterial Disease	1	8	37	0	2	0	0	2	49	
Pruning (0.5 min/plant)	15	172	0	0	0	0	0	7	179	
Acidification	0	0	44	0	0	0	0	4	48	
Wood Waste	1	16	100	0	212	16	12	4	360	
Fertilize-Urea Sulfuric Acid	9	104	740	0	0	0	0	46	890	
Fertilize-Ammonium Sulfate	6	95	12	0	18	2	5	6	138	
Fertilize-Iron Chelate	8	94	120	0	0	0	0	13	227	
Pollination	0	0	0	250	0	0	0	21	271	
Bird Control	24	378	0	0	40	2	124	36	580	
TOTAL CULTURAL	237	2977	1674	250	332	23	197	326	5779	
HARVEST:										
Picking	0	0	0	9800	0	0	0	82	9882	
Packing	0	0	0	21000	0	0	0	175	21175	
Cooling and Handling	0	0	0	9100	0	0	0	76	9176	
Marketing and Brokerage Fees	0	0	0	9100	0	0	0	76	9176	
TOTAL HARVEST	0	0	0	49000	0	0	0	409	49409	
TOTAL OPERATING COSTS		2977	1674	49250	332	23	197	735	55188	
CASH OVERHEAD:										
Liability Insurance									44	
Office Expenses									350	
Interest- Cash Overheads									96	
Leaf Analysis									20	
Soil Analysis									25	
Field Sanitation									270	
Investment Property Taxes									436	
Investment Property Insurance									305	
Investment Repairs									442	
TOTAL CASH OVERHEAD COSTS									1988	
NON-CASH OVERHEAD:										
					Unit Price		Capital Recovery			
					\$ Per Acre		Per Year (\$)			
Irrigation System					3500		317		317	
Land					35000		2537		2537	
Shop Building					2000		181		181	
Shop Tools					500		44		44	
Establishment Costs- Accumulated Net Cash Cost					6807		655		655	
Bird Control-Net					2300		565		565	
Bird Control -Rest of Material (Post, Wire, Cement and Labor)					2033		191		191	
TOTAL NON-CASH OVERHEAD COSTS									4490	
TOTAL COSTS									61666	

Table 4. Costs and Returns per Acre to Produce Blueberries in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007

		Quantity Per Acre	Unit	Price or Cost Per Unit (\$)	Value or Cost Per Acre (\$)	Your Cost (\$)
GROSS RETURNS: BLUEBERRY		14000	lbs	6.55	91700	
OPERATING COSTS						
Irrigation :	Water	24	acin	22.1	530	
Herbicide:	Roundup	1	gal	43.3	43	
Fungicide:	Rovral	2	lbs	24	48	
Bacterial Disease:						
	Kocide	6	lbs	6.23	37	
Acidification:	Sulfur	200	lbs	0.22	44	
Wood Waste:	Wood Waste	10	tons	10	100	
Fertilizer:	Urea Sulfuric Acid	1645	lbs	0.45	740	
	Ammonium Sulfate	115	lbs	0.105	12	
	Iron Chelate	20	lbs	6	120	
Pollination:						
	Beehive	2	each	125	250	
Harvest:	Picking	14000	lbs	0.7	9800	
	Packing	14000	lbs	1.5	21000	
	Cooling and Handling	14000	lbs	0.65	9100	
	Marketing and Brokerage Fees	14000	lbs	0.65	9100	
Labor (Machine)		54.6	hrs	13.15	718	
Labor (Non-machine)		191.4	hrs	11.8	2259	
Fuel - Gas		50.46	gal	2.8	141	
Furl - Diesel		3.78	gal	2.3	9	
Oil and Lubricant					22	
Machinery Repair					25	
Interest on Operating Capital at @10%					735	
TOTAL OPERATING COSTS					54834	
NET RETURNS ABOVE OPERATING COSTS					36866	
CASH OVERHEAD COSTS						
Liability Insurance					44	
Office Expenses					350	
Interest- Cash Overheads					96	
Leaf Analysis					20	
Soil Analysis					25	
Field Sanitation					270	
Property Taxes					449	
Property Insurance					314	
Investment Repairs					442	
TOTAL CASH OVERHEAD COSTS					2010	
TOTAL CASH COSTS					56844	
NET RETURNS ABOVE CASH COSTS					34856	
NON-CASH OVERHEAD COSTS(CAPITAL RECOVERY)						
Irrigation System					317	
Land					2537	
Shop Building					181	
Shop Tools					44	
Establishment Costs- Accumulated Net Cash Cost (Bushes)					655	
Bird Control-Net					565	
Bird Control -Rest of Material (Post, Wire, Cement and Labor)					191	
Equipment					331	
TOTAL NON-CASH OVERHEAD COSTS					4821	
TOTAL ALL COSTS					61665	
NET RETURNS ABOVE TOTAL ALL COSTS					30035	

Table 5. Monthly Cash Costs per Acre to Produce Blueberries in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007

Beginning JAN 07 Ending DEC 07	Costs Per Acre (\$)												TOTAL
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
CULTURAL:													
Irrigate		69	86	69	86	69	86	86	69	69			759
Weed Control	944						944	52					1940
Mow Strip				8				8				8	24
Fungicide							32					32	65
Bacterial Disease									46				46
Pruning								172					172
Acidification-Sulfur			44										44
Wood Waste									127				127
Fertilize-Urea Sulfuric Acid		83	86	83	86	83	86	86	83	83	83		844
Fertilize-Ammonium Sulfate	9	9	9	9	9	10	10	10	10	10	10	9	112
Fertilize-Iron Chelate				54	54	54	54						214
Pollination			250										250
Bird control	84	84	84	84	84							84	502
TOTAL CULTURAL COSTS	1037	245	559	307	319	216	1212	414	335	162	162	133	5099
HARVEST:													
Picking												9800	9800
Packing												21000	21000
Cooling and Handling												9100	9100
Marketing and Brokerage Fees												9100	9100
TOTAL HARVEST COSTS	0	0	0	0	0							49000	49000
Interest on Operating Capital	9	11	15	18	21	22	32	36	39	40	41	451	735
TOTAL OPERATING COSTS	1046	256	574	325	340	238	1244	450	374	202	203	49584	54834
CASH OVERHEAD:													
Liability Insurance												44	44
Office Expenses												350	350
Interest- Cash Overheads												96	96
Leaf Analysis												20	20
Soil Analysis												25	25
Field Sanitation												270	270
Property Taxes				225								225	449
Property Insurance				157								157	314
Investment Repairs	37	37	37	37	37	37	37	37	37	37	37	37	442
TOTAL CASH OVERHEAD COSTS	37	37	37	419	37	37	37	37	37	37	37	419	2010
TOTAL CASH COSTS	1083	293	611	744	377	275	1281	487	411	239	622	50426	56843

**Table 6. Whole Farm Equipment, Investment, and Business Overhead Costs Based on
a- 10 Acre Blueberry Farm in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007**

EQUIPMENT

Year	Description	Life (Year)	Price (\$)	Capital Recovery (\$)	Cash Overhead Costs (\$)		Total Costs (\$)
					Insurance	Taxes	
2007	70 HP 2WD Tractor	12	28850	3522	111	159	3792
2007	ATV 4WD	7	4500	791	17	25	833
2007	Bin Trailer #1	15	1000	108	4	6	118
2007	Mower - Rotary 5'	5	3000	685	12	16	713
2007	Power Sprayer	10	3000	411	12	16	439
TOTAL			40350	5517	156	222	5895
60% of Equipment Costs*			24210	3310	94	133	3537

*Used to reflect a mix of new and used equipment.

INVESTMENT

Description	Life (Years)	Price (\$)	Capital Recovery (\$)	Cash Overhead Costs (\$)			Total Costs (\$)	
				Insurance	Taxes	Repairs		
Bird Control-Net	5	23000	5647	81	115	1150	6993	
Bird Control-Rest of Material (Post, Wire, Cement and Labor)	21	20330	1914	71	102	1017	3104	
Establishment Costs- Accumulated Net Cash Cost	20	68070	6551	238	340	0	7129	
Irrigation System	23	35000	3172	123	175	1750	5220	
Land Rent	23	350000	25375	2450	3500	0	31325	
Shop Building	23	20000	1812	70	100	400	2382	
Shop Tools	23	5000	444	19	28	100	591	
TOTAL INVESTMENT			521400	44915	3052	4360	4417	56744

BUSINESS OVERHEAD

Description	Units Per Farm	Unit	Price Per Unit (\$)	Total Costs (\$)
Field Sanitation	10	acre	270	2700
Interest -Cash Overhead	10	acre	96	960
Leaf Analysis	10	acre	20	200
Liability Insurance	10	acre	44	440
Office Expenses	10	acre	350	3500
Soil Analysis	10	acre	25	250

**Table 7. Hourly Equipment Costs to Produce Blueberries in San Luis Obispo, Santa Barbara,
and Ventura Counties, 2007**

Year	Description	Actual Hours Used	Capital Recovery	Cash overhead		Cost (\$)/per hour*				Total Cost per Hour
				Insurance	Taxes	Total Cash Overhead	Operating Expenses Repairs	Fuel & Lubricants	Total Operating Expenses	
2007	70 HP 2WD Tractor	11	192.1	6.06	8.66	14.72	1.25	9.09	10.34	217.16
2007	ATV 4WD	385	1.23	0.03	0.04	0.07	0.33	4.22	4.55	5.85
2007	Bin Trailer #1	250	0.26	0.01	0.01	0.02	0.15	0	0.15	0.43
2007	Mower - Rotary 5'	15	27.39	0.46	0.66	1.12	0.29	0	0.29	28.80
2007	Power Sprayer	80	3.08	0.09	0.12	0.21	0.8	0	0.8	4.09

* Costs are based on 60% of the values of assets to reflect the mix of old and new equipment components.

Table 8. Range Analysis: Analysis of Costs and Returns for Producing Blueberries at Varying Yields and Prices in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007

Harvesting Costs

3.50 \$ Per Pound

	Yield (Pounds per Acre)						
	9800	11200	12600	14000	15400	16800	18200
OPERATING COSTS:							
Cultural Cost (\$)	5099	5099	5099	5099	5099	5099	5099
Harvest Cost (\$)	34300	39200	44100	49000	53900	58800	63700
Interest on Operating Capital (\$)	515	588	662	735	809	882	956
TOTAL OPERATING COSTS PER ACRE (\$)	39914	44887	49861	54834	59808	64781	69755
TOTAL OPERATING COSTS PER POUNDS (\$)	4.07	4.01	3.96	3.92	3.88	3.86	3.83
CASH OVERHEAD COSTS PER ACRE (\$)	2010	2010	2010	2010	2010	2010	2010
TOTAL CASH COSTS PER ACRE (\$)	41924	46897	51871	56844	61818	66791	71765
TOTAL CASH COSTS POUNDS (\$)	4.28	4.19	4.12	4.06	4.01	3.98	3.94
NON-CASH OVERHEAD COSTS PER ACRE (\$)	4821	4821	4821	4821	4821	4821	4821
TOTAL ALL COSTS (\$)	46745	51718	56692	61665	66639	71612	76586
TOTAL ALL COSTS (\$)	4.77	4.62	4.50	4.40	4.33	4.26	4.21

Net Returns per Acre Above Operating Costs at Varying Yield and Prices

Price (\$ Per Pound)	Yield (Pounds per Acre)						
	9800	11200	12600	14000	15400	16800	18200
	Net Returns Per Acre Above Operating Costs (\$)						
4.58	4971	6409	7848	9286	10725	12163	13602
5.24	11439	13801	16164	18526	20889	23251	25614
5.89	17809	21081	24354	27626	30899	34171	37444
6.55	24277	28473	32670	36866	41063	45259	49456
7.21	30745	35865	40986	46106	51227	56347	61468
7.86	37115	43145	49176	55206	61237	67267	73298
8.51	43485	50425	57366	64306	71247	78187	85128

Net Returns per Acre Above All Cash Costs at Varying Yield and Prices

Price (\$ Per Pound)	Yield (Pounds per Acre)						
	9800	11200	12600	14000	15400	16800	18200
	Net Returns Per Acre Above Cash Costs At Varying Yield and Prices (\$)						
4.58	2961	4399	5838	7276	8715	10153	11592
5.24	9429	11791	14154	16516	18879	21241	23604
5.89	15799	19071	22344	25616	28889	32161	35434
6.55	22267	26463	30660	34856	39053	43249	47446
7.21	28735	33855	38976	44096	49217	54337	59458
7.86	35105	41135	47166	53196	59227	65257	71288
8.51	41475	48415	55356	62296	69237	76177	83118

Net Returns per Acre Above Total Costs at Varying Yield and Prices

Price (\$ Per Pound)	Yield (Pounds per Acre)						
	9800	11200	12600	14000	15400	16800	18200
	Net Returns Per Acre Above Total Costs at Varying Yield and Prices (\$)						
4.58	-1861	-422	1017	2455	3894	5332	6771
5.24	4608	6970	9333	11695	14058	16420	18783
5.89	10978	14250	17523	20795	24068	27340	30613
6.55	17446	21642	25839	30035	34232	38428	42625
7.21	23914	29034	34155	39275	44396	49516	54637
7.86	30284	36314	42345	48375	54406	60436	66467
8.51	36654	43594	50535	57475	64416	71356	78297

Table 9. Break-Even Prices (\$ Per Pound) of Blueberry Production in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007

Break-Even Prices(\$ Per Pound) to Cover Costs Using our Yield Assumption			
Yield (Pounds Per Acre)	Operating Costs	Cash Costs	Total Costs
14,000	3.92	4.06	4.40

Table 10. Break-Even Yields (Pounds Per Acre) of Blueberry Production in San Luis Obispo, Santa Barbara, and Ventura Counties, 2007

Break-Even Yield (Pounds Per Acre) to Cover Costs Using Our Price Assumptions			
Price (\$Per Pound)	Operating Costs	Cash Costs	Total Costs
6.55	8,372	8,679	9,415

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- Small Farm Center, University of California Davis, <http://www.sfc.ucdavis.edu/research/blueberry.html>

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