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Costs of Producing Oranges in California and Florida, 1988/89

Boyd M. Buxton

Abstract. *Cost-of-production data were collected in March 1990 for oranges in the two leading U.S. orange-producing States (Florida and California) as part of the U.S. Department of Agriculture's (USDA) Farm Costs and Returns Survey. For the 1988/89 season, cash receipts per acre minus both variable and fixed cash expenses and capital replacement were positive for oranges in both States. Total economic costs per box of oranges were estimated to be $7.29 in California (75-pound box) and $7.48 in Florida (90-pound box). Returns above full economic costs were also positive in both States. Return to management was $311 per acre in Florida and $174 per acre in California.*

In March 1990, cost of production (COP) information for the Nation's orange crop was collected for the first time as part of the U.S. Department of Agriculture's Farm Costs and Returns Survey (FCRS). Reliable farm cost-of-production information contributes to better decisionmaking and planning in the orange industry. Growers, prospective growers, agricultural lenders, and others concerned with the citrus industry should find the information valuable for estimating the financial requirements of producing and maintaining orange groves. FCRS data can be useful for making production decisions such as selection among alternative crops. The long-term competitive position and the likely future adjustments of the U.S. orange industry in an expanding global market can also be better evaluated. FCRS information can be the basis for comparisons with costs in Brazil and other major competitors. Cost-of-production estimates aid industry and government policymakers in making decisions with regard to international trade and domestic programs and regulations that affect the U.S. orange industry.

The FCRS is conducted annually by the Economic Research Service (ERS) and the National Agricultural Statistics Service (NASS). It is a random sample of all U.S. farms and includes a selected set of crops on which detailed costs of production are collected each year. To expand the coverage of crops for which COP estimates are made, questionnaires were enumerated for a sample of orange grove operators in March 1990 in two major U.S. orange-producing States, Florida and California. This report presents the State-level COP data for oranges, estimated from information collected on the FCRS and other secondary sources.

For the 1988/89 crop year, 8.9 million tons of oranges, worth $1.85 billion, were produced in the United States on over 580,000 acres. Florida accounted for 73.7 percent of the total U.S. orange crop that season while California accounted for 24.7 percent. Arizona and Texas, the only other States with significant commercial production, together accounted for the remaining 1.6 percent of the U.S. total.

About 95 percent of the Florida orange crop is used for processing, mostly into frozen concentrated orange juice. In contrast, oranges in California are targeted for the fresh markets, both domestic and foreign. In 1988/89, 69 percent of the California orange crop went for fresh use, representing almost 89 percent of the total value of production in that State.

Orange Farm Characteristics

In Florida, 64 useable questionnaires were received from a sample of 201 orange operations. Many of these operations produced more than oranges, as they

averaged 409 total acres of crops, of which 131 acres were Valencia, early, midseason, or navel oranges (table 1). Only 56 percent of the surveyed orange acres in Florida had trees of bearing age. The remaining 44 percent of orange acres were planted either in 1989 or before 1989, but were not yet bearing in that year. This high proportion of acres with non-bearing trees reflects both replacement of frozen trees and expansion of orange acreage, primarily farther south in the State. Seventy percent of the orange operations surveyed in Florida had less than 50 acres of oranges and accounted for less than 10 percent of the Florida orange acreage. The other 30 percent of the operations surveyed in Florida had 50 or more acres of oranges and accounted for over 90 percent of the Florida orange acreage.

In California, 109 useable questionnaires were received from a sample of 324 orange operations. Many of these operations produced more than oranges, as they averaged 139 total acres of crops, of which 38 acres were either Valencia or navel oranges (table 1). Ninety-six percent of the orange acres in California had trees bearing fruit, with the remaining acres having trees not yet in production in 1988/89. Over 76 percent of the California orange operations surveyed had fewer than 50 acres of oranges and accounted for 26 percent of the orange acreage. The remaining 24 percent of the operations had 50 or more acres and accounted for 74 percent of the orange acreage.

Method of Analysis

The estimated costs of producing oranges are presented as an enterprise budget on a per-acre unit basis. The budget separates cost and return measures into three categories: cash receipts, cash expenses, and economic (full-ownership) costs. Although estimating procedures differ, the categories are consistent with budgets prepared for other commodities by the Economic Research Service (ERS).

The budgets reported here are calculated on a per-acre basis where the total orange acres include the mix of bearing and non-bearing trees that existed on the FCRS sample of orange operations. Therefore, the per-acre COP estimates include costs of both bearing and non-bearing trees. Sales revenues from fruit are spread over the total acres, both bearing and non-bearing. To the extent that the mix of bearing and non-bearing acres in 1988/89 represents the long-term mix of trees needed to maintain productive groves, the estimated cost for 1988/89 production represents longrun orange costs of production.

Cash Receipts

Cash receipts per acre are calculated by multiplying the total boxes produced per total acres of both bearing and non-bearing trees by the price per box. Yields in boxes per acre are calculated from survey data. These yields will differ from those reported by NASS

Table 1–Size distribution of orange operations in Florida and California, Farm Costs and Returns Survey, 1988/89

Item	Florida		California	
	Farms	Acres	Farms	Acres
		Number		
Farms surveyed:	64	--	109	--
Average total acres/farm	--	409.0	--	139.0
Average orange acres/farm	--	131.0	--	38.0
Average acres planted, 1989	--	4.0	--	.6
Average other non-bearing acres	--	53.7	--	1.0
Average bearing acres	--	73.3	--	36.4
		Percent		
Acres/operation:				
Fewer than 10	14.4	.8	36.9	3.1
10 to 29.9	45.6	5.9	26.4	10.9
30 to 49.9	10.4	2.9	13.1	12.2
50 to 99.9	7.9	4.5	9.6	16.8
100 to 249.9	13.5	15.6	13.1	48.2
250 to 499.9	5.4	13.8	.9	8.8
500 or more	2.8	56.6	0	0
Total	100.0	100.0	100.0	100.0

— = Not applicable.

because NASS yields are for bearing acres only. Yields are in terms of the standard 90-pound boxes in Florida and 75-pound boxes in California. The all-orange price per box (fresh and processed) for the 1988/89 crop year is that at the packinghouse door and reported by NASS.

Variable Cash Expenses

Two types of cash expenses, variable and fixed, are reported in this study. Variable cash expenses are separated into 10 categories: (1) nursery stock, trees, and seed, (2) fertilizer, (3) chemical and biological pest control, (4) custom operations and equipment rental, (5) fuel, lubrication, and electricity, (6) repairs, (7) hired labor, (8) purchased irrigation water, (9) interest on operating loans, and (10) miscellaneous expenses. Crop insurance expenses were excluded from the above categories because insurance claims were excluded from cash receipts. This treatment is consistent with procedures used for other crops in the ERS COP program.

Survey respondents reported the dollar value of expenses for all variable cash expense categories. For fertilizer, chemical and biological pest control, and custom operations, operators reported the dollar value specifically associated with the orange enterprise. For nursery stock, trees, seed, hired labor, purchased irrigation water, fuel, lubrication, and electricity, the operator was asked to report the dollar value of expenses for the entire farm operation and then the separate percentage that was used for oranges. For the miscellaneous expenses and interest on operating loans, the operator reported total expenses for the entire operation. A percentage was then allocated to oranges based on oranges' proportion of the operation's total sales.

Fertilizer includes the cost of all fertilizer, lime, soil conditioners, micronutrients, and secondary nutrients applied to the orange crop. Also included is the cost of custom application, if it was impossible for the operator to separate application and material cost. When they could be separated, custom application of fertilizer was included with the custom operations and equipment rental category.

Chemicals include the total cost of all chemicals applied to oranges, such as insecticides, herbicides, fungicides, surfactants, and wetting agents. Like fertilizer, application costs were included only if custom application costs could not be separated from the material cost. Otherwise, custom application costs were included in the custom operations and equipment rental category.

Fuel, lubrication, and electricity include the dollars spent for all fuels, motor oils, and electricity for irrigation. Electricity for non-irrigation purposes was included in general grove overhead.

Repairs include the dollars spent for repairs and parts for motor vehicles, machinery, equipment, irrigation, and frost protection. This would include overhauls, tuneups, tubes, tires, and other repairs.

Hired labor includes total cash wages and cash bonuses paid to all hired workers (including any cash wages paid to family members). Cash wages paid to the operator are excluded. Hired labor also includes any contract labor where workers are paid by a crew leader, contractor, buyer, processor, cooperative, or other person having an oral or written agreement with the operator. Cash expenses for paid labor benefits such as life or health insurance, pension or retirement plans, workers' compensation, employer's share of Social Security, and unemployment taxes are included in the hired labor expense.

Purchased irrigation water includes the dollars spent for irrigation water and drainage assessments and fees. Also included are pumping and overhead costs for private association water.

Interest on operating loans includes both interest and service fees on operating loans.

Miscellaneous expenses include accessories for motor vehicles and machinery, office equipment purchases, marketing containers, and transportation of items to market or between farms.

Fixed Cash Expenses

Fixed cash expenses are separated into three categories: real estate and property taxes, interest on real estate debt, and general grove overhead.

Interest on real estate debt includes both interest and service fees secured by farmland, buildings, and other real estate debt. This includes the operator's dwelling if located on the operation.

General grove overhead is a composite of utilities such as non-irrigation electricity, telephone, and water; all insurance (other than crop insurance), such as the farm share on motor vehicle liability and blanket insurance

policies; registration and license fees for motor vehicles; and general business expenses, such as accounting fees, legal fees, travel, memberships, farm management services, soil testing, magazines, office supplies, co-op fees, and advertising. Purchases of farm supplies, hand tools, and farm and shop power equipment are also included in general grove overhead. Farm and land improvement and maintenance, such as fencing, operator's dwelling, hired labor and tenant dwellings, and other farm buildings, are included in general grove overhead.

Capital Replacement

Nonland capital was divided into five categories: vehicles, tractors, grove equipment, irrigation pumps and distribution systems, and frost protection equipment. Trees were not depreciated directly, as replacement costs were included in the costs for non-bearing acres on the surveyed operations. Information was collected on the number of vehicles in six categories (pickups, single-axle trucks, tandem-axle trucks, semi trucks, buses, and vans); the number of tractors in six size categories (less than 30 horsepower (hp), 30-39 hp, 40-59 hp, 60-109 hp, 110-169 hp, and 170 hp and above); and the items of each type of equipment used for orange production. For each vehicle and tractor category and equipment type, the operator was asked to report the percent of total use for oranges and the average age when items in each category were usually replaced. Based on this information, annual capital replacement was estimated using two engineering equations, one for vehicles and tractors and one for equipment, as follows:

Vehicles and tractors,

$$Captrac=\sum_i^n \frac{(NUM_i)\left(\frac{PCT_i}{100}\right)(I_i-(0.68)I_i(.92^{UL_i}))}{UL_i}$$

Equipment,

$$Capequip=\sum_i^m \frac{(NUM_i)\left(\frac{PCT_i}{100}\right)(I_i-(0.6)I_i(.885^{UL_i}))}{UL_i}$$

where:

Captrac = annual capital replacement for tractors and vehicles,
Capequip = annual capital replacement for grove equipment,
I = purchase price for new vehicles, tractors, or equipment,
NUM = the number of vehicles, tractors, or equipment in each category,
PCT = the percent of total use for oranges,
UL = the usual age in years when the item is replaced,
n = the number of vehicles or tractors in each category, and
m = the number of equipment items used for oranges.

The values are engineering coefficients commonly used in farm management studies.[1]

This procedure of computing capital replacement varied from the usual procedures, where operators were asked to report separately each vehicle, tractor, and equipment item.

Capital replacement costs for frost protection (excluding irrigation systems), mostly reflecting wind machines and grove heaters, were calculated using straight-line depreciation assuming zero salvage value, combined with information reported by the operator on the percentage of equipment used for oranges, and the age when it is usually replaced. Costs for installing electric-, gasoline-, diesel-, and propane-powered wind machines were obtained from equipment manufacturers and secondary sources.

For irrigation systems, capital replacement costs were calculated for pumps and distribution systems only. Wells were not depreciated, but were valued at drilling cost and included with land value. In many cases, wells transfer with land and would, therefore, enhance land values. Straight-line depreciation was assumed using zero salvage value with a 12-year useful life for pumps and 15 years for the distribution system. Drilling costs, pumps, and distribution costs were obtained from dealers and contractors in each State.

Full Economic Costs

Estimated economic or full-ownership costs indicate the average longrun cost that must be recovered annually from farm revenue to keep land in orange production and maintain the long-term viability of the enterprise. For full economic costs, a return is calculated for operating capital, other nonland capital, unpaid labor, and land. This total is added to variable cash expenses, general farm overhead, real estate and

[1] Vernon R.Eidman and Michael D. Boehlje, Farm Management, John Wiley and Sons, NY, 1983.

property taxes, and capital replacement. Any residual cash receipts, after subtracting full economic costs, are assumed to be a return to management and risk.

A rate of return to land and nonland capital is computed by using a 10-year total return to production assets in the agricultural sector (previous 10 years), minus the value of the operator's labor each year, and divided by the total market value of agricultural production assets. Average market value of nonland capital, including tractors, vehicles, and equipment, and the value of land reported by the survey respondents is multiplied by this 10-year average return. Earnings from inflation (capital gains or losses from depreciation) are not included in the orange enterprise budget.

Estimates of Orange Production Costs

The budgets reported here approximate the long-term costs and returns for maintaining an orange grove over time, reflecting the mix of new, non-bearing, and commercially producing trees in the FCRS. In Florida, 3 percent of the acres had trees that were planted in 1989, another 41 percent were planted before 1989 but were of non-bearing age in 1989, while 56 percent had trees that were of bearing age. In California, the mix of newly planted, young non-bearing, and bearing acres was 2, 3, and 95 percent, respectively. If the mix of bearing and non-bearing acres in the sample represented the long-term mix of trees needed to maintain productive groves, then the estimated cost for the 1988/89 production would represent longrun costs of production. However, the frequent freezes in Florida during the 1980's and the subsequent replacement of frozen trees, combined with expansion of new orange acres, resulted in a relatively high (44 percent) proportion of the orange acreage on operations surveyed having non-bearing trees. In California, only 4 percent of the acreage had trees of non-bearing age.

Cash Receipts

Cash receipts per acre were calculated by multiplying the 1988/89 season average price received for all oranges reported by NASS by the average yield per acre calculated from the survey. Average yield for all acres (including both bearing and non-bearing) was 314 boxes in California (75-pound boxes) and 175 boxes in Florida (90-pound boxes). The relatively low yields in Florida reflect the high proportion of non-bearing acres on surveyed operations.

Gross value per acre was estimated at $2,466 in California and $1,621 in Florida (table 2). These values are for the 1988/89 season and do not reflect the major Florida freeze in late December 1989.

Variable Cash Expenses

Total variable costs per acre were estimated at $1,458 for California and $811 for Florida (table 2). Hired labor was the single largest cash expense in both California and Florida, representing 40 and 37 percent of the total variable cash expenses. This labor cost includes picking and hauling, whether or not it was paid directly to workers, crew leaders, contractors, cooperatives, or others.

Fertilizers and chemicals, including biological pest control, also were major costs in both California and Florida. Expenses per acre were generally higher in California than in Florida. This relationship reflects the relatively high proportion of non-bearing trees on the sampled Florida operations where fertilizer and chemical costs are lower, and the higher proportion of oranges in California that are grown specifically for the fresh market. Oranges grown for fresh market use require more chemical inputs to improve the visual appearance of the fruit.

Fixed Cash Expenses

Fixed expenses totaled $445 per acre in California and $191 in Florida (table 2). General grove overhead accounted for about 44 percent of the total in California and 45 percent in Florida. Interest on real estate debt was significantly higher in California than in Florida. Real estate and property taxes per acre were estimated at $77 in California and $72 in Florida.

Capital Replacement

Total capital replacement costs were estimated at $148 per acre in California and $98 in Florida (table 2). In both States, capital replacement costs per acre for vehicles, tractors, and equipment were the largest component of capital replacement, with the irrigation system representing almost the same amount. Wind machines for frost protection are almost obsolete in Florida, but still used extensively in California.

Pumps and irrigation systems are a major investment for orange production. If wells were used as a source of irrigation water for orange groves, information was asked on the number of wells used, average depth, pumping lift, and casing diameter. Wells accounted for an estimated 38 percent of the water used on oranges in California and 73 percent in Florida. The smaller

Table 2–Orange cash receipts and production costs, California and Florida, 1988/89

Budget item	California	Florida
	Boxes/acres	
Yield 1/	314.17	175.09
	Dollars/acre	
Price (NASS, per box, 1988/89)	7.85	9.26
Cash receipts	2,466.23	1,621.33
Variable cash expenses:		
Nursery stock, trees, and seed	12.47	13.02
Fertilizer	98.66	141.27
Chemicals and biological pest control	210.73	139.28
Custom operations and rental	43.53	27.07
Fuel, lube, and electricity	143.46	38.47
Repairs	123.31	53.39
Hired labor	589.41	298.99
Purchased irrigation water	97.96	.30
Interest on operating loans	31.90	18.60
Miscellaneous	106.47	80.60
Total variable expenses	1,457.90	810.99
Fixed cash expenses:		
Real estate and property tax	77.62	72.25
Interest on real estate debt	169.32	32.06
General grove overhead	198.36	86.88
Total fixed expenses	445.30	191.19
Total cash expenses	1,903.20	1,002.18
Capital replacement:		
Vehicles	21.72	12.84
Tractors	14.01	12.92
Equipment	20.02	8.40
Irrigation system:		
Pumps	14.72	18.25
Distribution system	40.64	45.57
Wind machines (regular and power takeoff)	37.20	.08
Total capital replacement	148.31	98.06
Cash receipts less cash expenses and capital replacement	414.72	521.09
Economic (full-ownership) costs:		
Total variable expenses less interest on operating loans	1,426.00	792.39
General grove overhead	198.36	86.88
Real estate and property tax	77.62	72.25
Capital replacement	148.31	98.06
Allocated returns to owned inputs:		
Return to operating capital	66.61	35.08
Return to other nonland capital	41.27	21.80
Return to land	217.52	173.99
Unpaid labor (at $5/hour)	116.05	29.85
Total economic costs:		
Per/acre	2,291.74	1,310.30
Per/box	7.29	7.48
Cents per pound	9.7	8.3
Returns to management and risk	174.49	311.03

1/ Box weight: California, 75 pounds; Florida, 90 pounds. Yields are total production divided by total acres, both bearing and non-bearing. COP estimates include costs for both bearing and non-bearing acres on sampled operations.

proportion of water from wells in California compared with Florida reflects the relative importance of runoff water from mountain watersheds that California growers purchase from irrigation districts or other non-well sources.

The average well in Florida was 530 feet deep, with a 51-foot pumping lift, and an 8-inch casing diameter. In contrast, wells in California averaged 223 feet deep with a 115-foot pumping lift, and a 10-inch casing diameter. The drilling costs per well were calculated using the following equations based on secondary information from drilling companies in both States:

California,
$6,711.25 = $300 + $28.75 x (223 [average depth]),

Florida,
$12,395.00 = $1,000 + $21.50 x (530 [average depth]).

The higher constant term in Florida ($1,000) than in California ($300) reflects primarily higher costs for well-drilling permits. The lower drilling cost per foot in Florida is mostly due to the 8- rather than 10-inch casing diameter. Secondary sources indicated that the costs of the motor and pump for the well, including installation, were about equal to the drilling costs in both States.

The most common irrigation system in Florida was micro-sprinklers. This type of water distribution system was used on about 58 percent of the orange groves in that State (table 3). Solid set sprinklers, either over or under the trees, accounted for another 26 percent of the Florida orange operations. In contrast, only 11 percent of the operations in California reported using the micro-sprinkler irrigation system with 29 percent reporting solid set sprinklers placed under the trees. About 28 percent reported gravity flow irrigation systems, unlike Florida where less than 8 percent reported gravity flow systems. Hand-moved sprinklers accounted for over 16 percent of the systems reported in California, while none were reported in Florida. Drip irrigation accounted for about 10 percent in California compared with 6 percent in Florida.

Investment for the irrigation systems was obtained from irrigation companies in both States. The investment per acre for micro-sprinklers and drip irrigation systems declines for larger installations up to 160 acres. For installations of 160 acres or more, investment per acre was estimated at $600 for micro-sprinklers and $450 for drip systems. These costs include all booster pumps, mainlines, tree line pipes, and sprinklers or drippers.

Capital replacement costs for pumps used in the well only, assuming zero salvage value and a 12-year useful life, were about $15 per acre in California and $18 in Florida. Capital replacement costs for the distribution systems, including booster pumps, were estimated at about $41 per acre in California and $46 in Florida.

The use of wind machines for frost protection was reported by about 60 percent of the operations in

Table 3–Percent of orange operations reporting irrigation systems, by type of system and State, 1988/89

System type	California	Florida
	Percent	
Pressure:		
Micro-sprinklers	10.8	57.5
Solid set sprinklers, under trees	28.9	15.0
Solid set sprinklers, over trees	1.7	11.4
Solid set drippers	2.1	2.5
Drip irrigation	7.6	3.6
Hand-moved sprinkler (drag line)	16.7	0
Big gun	0	2.3
Other	3.7	.2
Gravity flow:		
Flood or furrow	22.8	5.2
Gated pipe	5.2	2.3
Other	.5	0
Total	100.0	100.0

California, while only one operation in Florida reported using any. For operations with wind machines, information was obtained on the survey as to whether the wind machine was tower-mounted or powered by a tractor power takeoff, the age when usually replaced, and the proportion of total time it was used for oranges. Capital replacement for wind machines was calculated with this information combined with secondary sources on the new cost for tower-mounted wind machines, powered by gas, propane, and diesel, and a tractor power takeoff.

Return Above Expenses

Cash receipts less variable and fixed cash expenses and capital replacement left a positive $415 per acre in California and $521 in Florida (table 2).

Full Economic Costs

Interest on operating loans and real estate debt was subtracted from the sum of total cash expenses and capital replacement. Allocated returns to owned inputs including operating capital, other nonland capital, land and wells, and unpaid labor were then added to provide an estimate of total economic costs per acre for producing oranges.

Returns to operating capital, other nonland capital, and land and wells were calculated by multiplying their average values by 2.8 percent, the 10-year average return. This 2.8-percent return was used in calculating full economic costs for all crops for which 1988/89 COP estimates were made. The return to land and wells was $174 per acre in Florida and $217 in California. The average value of land per acre was $7,592 ($7,769 including wells) in California and $5,995 ($6,214 including wells) in Florida. The estimated return per acre for operating and other nonland capital was $35 and $22 in Florida and $67 and $41 in California. Unpaid labor, valued at $5 per hour in both States, was estimated at $30 per acre in Florida and $116 in California, reflecting larger Florida operations that tended to spread available unpaid family labor over more acres.

Total economic costs in Florida were $1,310 per acre or $7.48 per 90-pound box and $2,292 in California or $7.29 per 75-pound box. Subtracting the full economic cost from cash receipts left a positive return to management and risk for producing oranges of $311 per acre in Florida and $174 per acre in California.