# State of California's Table and Olive Oil Industries, and Their Futures

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Currently California's table olive industry is facing three major challenges; the impact of manual labor, particularly pruning and harvesting, on fruit production costs, the rapid spread of the olive fruit fly, (OLF) and import competition. These may, or may not, pose problems for the developing California olive oil industry.

**Mechanical Pruning and Harvesting:**

The two major factors that drive up table olive production costs are the practices currently requiring manual labor, pruning and harvesting. The most recent table olive cost study by Glenn County Farm Advisor William H. Krueger and colleagues for flood irrigated olives projected a 5 ton per acre yield with annual cash costs of $2,403.00. Of this fertilization and manual weed control were 2% each, disease and pest control were 3% each, irrigation was 5%, hand pruning every other year was 8%, and hand harvest, at $275.00 per ton, was a stunning 57% of annual cash costs. The last dwarfs all other production costs and may in time render table olive production unprofitable. If manual pruning and harvesting are also used for oil olives these will be similarly high cost items in oil olive production.

The oil industry may have some advantage in that the orchards can be planted as high density hedgerows that, theoretically, are more amenable to combined mechanical topping and manual pruning and mechanical harvesting. A new cost UCCE cost study by Farm Advisors Paul Vossen and Joseph H. Connell, and Karen Klonsky, Extension Economist and Peter Livingston, Extension Staff Research Associate, of Department of Agricultural and Resource Economics at University of California at Davis details the cost of establishing a super high density olive oil orchard and producing olive oil.

My colleagues and I have investigated mechanical pruning with mature table olive cultivars. Our objective was to produce a tree that could be mechanically harvested; a tree with a 1m skirt, a 3.5m canopy and 4m tall. These were trees that needed to be reshaped, with mechanical pruning, into hedgerows. Thus the pruning was rehabilitation pruning. Generally the research demonstrated severe mechanical pruning, and particularly mechanical topping, into two year and older growth, sharply decreased crop the year of pruning. The general conclusion was that reshaping the trees would require at least two years of yield loss and strong vegetative regrowth that would require more mechanical pruning. It has not been demonstrated that mature trees, those over 10 years old, can be successfully reshaped for mechanical harvesting without unacceptable yield losses. Nor has it been demonstrated maintenance mechanical hedging can produce economic annual production. The current recommendation is biennial, light hedging, every other row, every other year, into 1 year old wood and annual light topping, to the height desired after regrowth, and on angle that produces a flat wall to the row through regrowth.

We have not had the opportunity to investigate the effect of mechanical pruning on young hedgerow table olives. A three year old trial at the Nickles Estate in Colusa County should be ready for some mechanical pruning and harvesting in three more years.

The developing olive oil industry may have an advantage in that many of the new olive oil plantings are hedgerows. Butte County Farm Advisor Joe Connell and Glenn Coounty Farm Advisor are currently cooperating in an irrigation experiment in a hedgerow planting of young oil olives. Their preliminary observation is that a mechanically harvestable shape can be maintained with mechanical topping and the manual pruning that also included removing the larger wood that would broken by the mechanical harvester. If mechanical topping is incorporated into olive oil production it can be started in young olives as a routine production practice, rather than a rehabilitation practice. It remains to be seen if the mechanically topped and manually pruned hedgerow olives can be maintained at the desired height, and in the desired shape, for mechanical harvesting and still produce economic oil yields. Whether these new

olive oil orchards are manually or mechanically pruned, or a combination of both, and mechanically harvested the objective will be the same. An orchard with enough fruit production, and low enough production costs, to produce a profitable net economic return after oil processing.

We have also had experience with mechanical harvesting of table olives. As with mechanical pruning we are again dealing with larger, older trees not specifically shaped for mechanical harvesting. And the olives are physiologically immature, thus the fruit does not detach easily from the stem. The final harvester design produced is a passively rotating head with padded, 1m rods radiating 360*. These rods have a 30cm whip at the end of the rod. This motion, against the sides of the hanging olive branches, is 90% effective in removing the fruit. Therefore the removal technology is effective, if the olives are accessible. However, thus far pruning the tree rows into an acceptable flat fruiting wall has produced unacceptable decreases in yield. Also, the harvesters thus far have inefficient catch frames, dropping 19% of the fruit harvested, and produce unacceptable bruising of the fruit according to one of the two major processors. Currently mechanical harvesting research is not being done on table olives.

Oil olives may have factors making them more amenable to mechanical harvesting. The olives are physiologically mature and will detach easily with the above harvester or shake harvesters. Being softer and less bouncy than immature table olives, they may not drop out of the catch frame as easily. And, if pressed promptly, fruit damage will not be an issue. Theoretically, as fruit, oil olives are ideal for mechanical harvest. In fact, the limiting factor may be the pressing mill capacity. This may be an issue if a contract harvester is used, as opposed to the grower owning harvesting equipment he can use at the desirred intervals.

Among the mechanical harvesters currently being used for oil olive harvest are over the row harvester originally designed for grapes. There is no published data thus far, for California, demonstrating that mature olive oil trees can be maintained at a size suitable for over the row harvesters, and produce acceptable yields, without unacceptable limb breakage. There is also no data demonstrating the effect of these harvesters on oil quality. However, the latter is not expected to be major.

In summary, the California table olive industry will need to develop at least partial mechanical pruning and harvesting practices if they are to compete in the global table olive market. The California olive oil industry will have to do develop mechanical harvesting and perhaps, partial mechanical pruning. Fortuitously, it appears the olive oil industry will have a better chance of developing successful mechanical harvesting than the table olive industry. However, currently, no mechanical pruning or harvesting research for oil or table olives is being done in California.

**Olive Fruit Fly:**

The olive fruit fly (OLF) is the second problem facing the California industry. This pest was detected in Los Angeles County in 1999 and within five years is present in 51 of the 57 counties in California. This single host pest is devastatingly effective because it does not kill its host, destroys fruit in a way that does not preclude production the following year, can travel significant distances, reportedly more than six miles, can overwinter in different developmental forms, is multigenerational within a season, and has no natural enemies in California.

Currently, the table olive industry is focusing its entire research effort on understanding the relationship between the developing olive fruit and the growth stages of the fly, locating natural enemies of the fly, developing chemical monitoring and control methods for the fly, evaluating the effect of cultural practices on fly populations, organizing pest control districts, and determining the effect of the fly on fruit and oil quality.

Preliminary research thus far indicates that, as with mechanical pruning and harvesting, the olive oil industry may have advantages over the table olive industry. First, the preliminary infestation data produced by Hannah Burrack, Frank Zalom and Louise Ferguson, of UC Davis Departments of Entomology and Pomology indicate the fly prefers the larger fruited table cultivars, over the smaller fruited oil cultivars. This suggests table cultivars could be indicator or trap crops. Second, preliminary work by

Hannah Nadel and Marshall Johnson of UC Riverside Department of Entomology indicates the fly larvae does not like to remain in late season fruit with a high oil content. If this is true, perhaps delaying the harvest of infested fruit until the larvae have exited, will produce usable oil. However, oil quality and longevity may be dependent upon the level of damage the fruit sustained before the larvae exited. Third, very preliminary work by Sonoma County Farm Advisor, Paul Vossen, University of California's primary olive oil expert, indicates heavy fly infestation may not decrease olive oil quality within the first few weeks of bottled oil shelf life. All these results are very preliminary. However, this is in stark contrast to the zero tolerance of table olive consumers for fly infestation or fruit damage in canned product.

The table olive industry may have two advantages over the developing olive oil industry. First, the fruit is harvested immature and thus is exposed to fly infestation for a shorter period of time. Second, preliminary results of Marshall Johnson suggest the hotter summer temperatures of the Central Valley are deleterious to olive fly activity, and larval development and survival in fruit. The cooler locations where oil olives are currently being planted may not have this annual climatic control. However, if the developing olive oil industry, in pursuit of higher yields and lower costs, begins planting in the Central Valley, they may benefit from the advantages of high heat decreasing fly activity and mortality, smaller cultivars that are less attractive to the fly, and a higher infestation tolerance in the processed oil. The net result might make it more profitable to grow oil than table olives in the Central San Joaquin Valley. If established orchards could be converted to oil production, even though they are the larger fruited cultivars, this would also be an advantage.

In summary, the table and olive oil industries are both threatened by the olive fly. And it appears they will need to work together to control this pest that is here to stay.

**Import Pressures:**

This is the third factor facing both the table and oil olive industries. I will not go into the topic in detail as other speakers at this meeting will be discussing global competition. Also, Olivae, the magazine published quarterly by the International Olive Oil Council in Madrid, Spain produces an excellent annual analysis of the world's table and oil olive industries.

The United States is among, and often is, the world's largest, importer of table olives and oil. We also are among the lowest, often the lowest, per capita consumers of table olives and oil. To the rest of the world's developed, Spain, Italy, Turkey, Morocco, and Tunisia, and developing, South America, Australia and South Africa, table olive and oil industries we appear to be a market of virtually unlimited potential. It is a market, as the local producers, we could have, if we cooperate in developing our two industries.

Table 2.

UC COOPERATIVE EXTENSION
COSTS to PRODUCE SUPER-HIGH DENSITY OLIVES for OIL
SACRAMENTO VALLEY – 2004
ARBEQUINA VARIETY

Labor Rate: $10.85/hr. machine labor
$9.87/hr. non-machine labor

Trees Per Acre: 670
Long Term Interest Rate: 6.23%

| Operation | Operation Time (Hrs/A) | Labor Cost | Fuel,Lube & Repairs | Material Cost | Custom/ Rent | Total Cost | Your Cost |
|---|---|---|---|---|---|---|---|
| | | ---------- Cash and Labor Costs per Acre ---------- | | | | | |
| Cultural: | | | | | | | |
| Spring Pruning | 20.00 | 196 | 0 | 0 | 0 | 196 | |
| Weed Control - Strip Spray | 0.19 | 3 | 0 | 1 | 0 | 4 | |
| Weed Control - Mow Middles 3X | 1.00 | 13 | 11 | 0 | 0 | 24 | |
| Disease Control - Olive Knot & Peacock Spray | 0.33 | 4 | 3 | 19 | 0 | 27 | |
| Weed Control - Spot Spray | 0.19 | 3 | 0 | 1 | 0 | 4 | |
| Irrigate | 0.80 | 8 | 0 | 94 | 0 | 102 | |
| Fertilizer - Nitrogen | 0.80 | 8 | 0 | 18 | 0 | 25 | |
| Skirt Prune Trees (1 of 2 Years) | 0.00 | 0 | 0 | 0 | 3 | 3 | |
| Pest Control - Olive Fruit Fly 9X | 3.00 | 39 | 30 | 72 | 0 | 140 | |
| Top Prune Trees (1 of 2 Years) | 0.00 | 0 | 0 | 0 | 7 | 7 | |
| Pickup Truck Use | 4.83 | 63 | 35 | 0 | 0 | 98 | |
| TOTAL CULTURAL COSTS | 31.16 | 336 | 79 | 205 | 10 | 630 | |
| Harvest: | | | | | | | |
| Harvest | 0.00 | 0 | 0 | 0 | 135 | 135 | |
| Haul Fruit to Processor | 0.00 | 0 | 0 | 0 | 75 | 75 | |
| TOTAL HARVEST COSTS | 0.00 | 0 | 0 | 0 | 210 | 210 | |
| Postharvest: | | | | | | | |
| Disease Control - Olive Knot & Peacock Spray | 0.33 | 4 | 3 | 19 | 0 | 27 | |
| Weed Control - Residual Weed Spray | 0.19 | 3 | 0 | 8 | 0 | 11 | |
| Pest Control - Olive Fruit Fly 1X | 0.33 | 4 | 3 | 8 | 0 | 16 | |
| TOTAL POSTHARVEST COSTS | 0.86 | 11 | 7 | 35 | 0 | 53 | |
| Interest on operating capital @ 6.89% | | | | | | 19 | |
| TOTAL OPERATING COSTS/ACRE | | 347 | 86 | 240 | 219 | 911 | |
| CASH OVERHEAD: | | | | | | | |
| Office Expense | | | | | | 167 | |
| Liability Insurance | | | | | | 13 | |
| Sanitation Fees | | | | | | 7 | |
| Property Taxes | | | | | | 92 | |
| Property Insurance | | | | | | 62 | |
| Investment Repairs | | | | | | 41 | |
| TOTAL CASH OVERHEAD COSTS | | | | | | 382 | |
| TOTAL CASH COSTS/ACRE | | | | | | 1,294 | |
| NON-CASH OVERHEAD: | | | | | | | |
| Investment | | Per producing Acre | | -- Annual Cost -- Capital Recovery | | | |
| Shop Building - 1,200 SqFt | | 920 | | 67 | | 67 | |
| Fuel Tank & Pump | | 50 | | 4 | | 4 | |
| Shop Tools | | 217 | | 28 | | 28 | |
| Land @ $3,000 Per Acre | | 3,000 | | 187 | | 187 | |
| Drip Irrigation System | | 3,800 | | 258 | | 258 | |
| Olive Orchard Establishment Cost | | 6,164 | | 430 | | 430 | |
| Equipment | | 647 | | 81 | | 81 | |
| TOTAL NON-CASH OVERHEAD COSTS | | 14,798 | | 1,056 | | 1,056 | |
| TOTAL COSTS/ACRE | | | | | | 2,349 | |

Table 3

UC COOPERATIVE EXTENSION
COSTS and RETURNS to PRODUCE SUPER-HIGH DENSITY OLIVES for OIL
SACRAMENTO VALLEY – 2004
ARBEQUINA VARIETY

| | Quantity/Acre | Unit | Price or Cost/Unit | Value or Cost/Acre | Your Cost |
|---|---|---|---|---|---|
| GROSS RETURNS | | | | | |
| Olive for Oil | 5.0 | Ton | 450 | 2,250 | |
| TOTAL GROSS RETURNS FOR OLIVE OIL | | | | 2,250 | |
| OPERATING COSTS | | | | | |
| Herbicide: | | | | | |
| Karmex DF | 0.25 | Lb | 5.09 | 1 | |
| Roundup Ultra | 0.40 | Pint | 6.06 | 2 | |
| Goal 2 XL | 0.50 | Pint | 13.32 | 7 | |
| Fungicide: | | | | | |
| Kocide 101 | 20.00 | Lb | 1.90 | 38 | |
| Water: | | | | | |
| Water - Pumped | 24.00 | AcIn | 3.93 | 94 | |
| Fertilizer: | | | | | |
| UN-32 | 45.04 | Lb N | 0.391 | 18 | |
| Custom: | | | | | |
| Skirt Pruning | 1.00 | Acre | 3.00 | 3 | |
| Top Pruning | 1.00 | Acre | 6.50 | 7 | |
| Hauling | 5.00 | Ton | 15.00 | 75 | |
| Insecticide: | | | | | |
| GF-120 | 140.00 | FlOz | 0.57 | 80 | |
| Contract: | | | | | |
| Harvest-Mechanical | 1.00 | Acre | 135.00 | 135 | |
| Labor (machine) | 12.50 | hrs | 10.85 | 136 | |
| Labor (non-machine) | 21.60 | hrs | 9.78 | 211 | |
| Fuel - Gas | 12.47 | gal | 1.88 | 23 | |
| Fuel - Diesel | 14.87 | gal | 1.45 | 22 | |
| Lube | | | | 7 | |
| Machinery repair | | | | 35 | |
| Interest on operating capital @ 6.89% | | | | 19 | |
| TOTAL OPERATING COSTS/ACRE | | | | 911 | |
| NET RETURNS ABOVE OPERATING COSTS | | | | 1,339 | |
| CASH OVERHEAD COSTS: | | | | | |
| Office Expense | | | | 167 | |
| Liability Insurance | | | | 13 | |
| Sanitation Fees | | | | 7 | |
| Property Taxes | | | | 92 | |
| Property Insurance | | | | 62 | |
| Investment Repairs | | | | 41 | |
| TOTAL CASH OVERHEAD COSTS/ACRE | | | | 382 | |
| TOTAL CASH COSTS/ACRE | | | | 1,294 | |
| NON-CASH OVERHEAD COSTS (CAPITAL RECOVERY): | | | | | |
| Buildings: 1,200 SqFt | | | | 67 | |
| Fuel Tank: 1-100 Gallon | | | | 4 | |
| Shop Tools | | | | 28 | |
| Land | | | | 187 | |
| Drip Irrigigation System | | | | 258 | |
| Olive Orchard Establishment Cost | | | | 430 | |
| Equipment | | | | 81 | |
| TOTAL NON-CASH OVERHEAD COST/ACRE | | | | 1,056 | |
| TOTAL COSTS/ACRE | | | | 2,349 | |
| NET RETURNS ABOVE TOTAL COSTS | | | | -99 | |

Table 7.

UC COOPERATIVE EXTENSION
RANGING ANALYSIS
SACRAMENTO VALLEY - 2004
ARBEQUINA VARIETY

| | YIELD(TON/ACRE) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | 6.5 |
| OPERATING COSTS/ACRE: | | | | | | | |
| Cultural Cost | 630 | 630 | 630 | 630 | 630 | 630 | 630 |
| Harvest Cost | 188 | 195 | 203 | 210 | 217 | 225 | 233 |
| Post Harvest Cost | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| Interest on operating capital | 18 | 19 | 19 | 19 | 19 | 19 | 19 |
| TOTAL OPERATING COSTS/ACRE | 889 | 896 | 904 | 911 | 919 | 927 | 934 |
| TOTAL OPERATING COSTS/TON | 254 | 224 | 201 | 182 | 167 | 154 | 144 |
| CASH OVERHEAD COSTS/ACRE | 382 | 382 | 382 | 382 | 382 | 382 | 382 |
| TOTAL CASH COSTS/ACRE | 1,271 | 1,279 | 1,286 | 1,294 | 1,301 | 1,309 | 1,316 |
| TOTAL CASH COSTS/TON | 363 | 320 | 286 | 259 | 237 | 218 | 203 |
| NON-CASH OVERHEAD COSTS/ACRE | 1,056 | 1,056 | 1,056 | 1,056 | 1,056 | 1,056 | 1,056 |
| TOTAL COSTS/ACRE | 2,327 | 2,334 | 2,342 | 2,349 | 2,357 | 2,364 | 2,372 |
| TOTAL COSTS/TON | 665 | 584 | 520 | 470 | 429 | 394 | 365 |

NET RETURNS PER ACRE ABOVE **OPERATING COSTS** FOR SUPER-HIGH ~~DE~~NSITY OLIVES FOR OIL

| PRICE (DOLLARS/TON) | YIELD (TONS/ACRE) | | | | | | |
|---|---|---|---|---|---|---|---|
| Olives for Oil | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | 6.5 |
| | $/Acre | | | | | | |
| 300 | 161 | 304 | 446 | 589 | 731 | 873 | 1,016 |
| 350 | 336 | 504 | 671 | 839 | 1,006 | 1,173 | 1,341 |
| 400 | 511 | 704 | 896 | 1,089 | 1,281 | 1,473 | 1,666 |
| 450 | 686 | 904 | 1,121 | 1,339 | 1,556 | 1,773 | 1,991 |
| 500 | 861 | 1,104 | 1,346 | 1,589 | 1,831 | 2,073 | 2,316 |
| 550 | 1,036 | 1,304 | 1,571 | 1,839 | 2,106 | 2,373 | 2,641 |
| 600 | 1,211 | 1,504 | 1,796 | 2,089 | 2,381 | 2,673 | 2,966 |

NET RETURNS PER ACRE ABOVE **CASH COSTS** FOR SUPER-HIGH DENSITY OLIVES FOR OIL

| PRICE (DOLLARS/TON) | YIELD (TONS/ACRE) | | | | | | |
|---|---|---|---|---|---|---|---|
| Olives for Oil | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | 6.5 |
| | $/Acre | | | | | | |
| 300 | -221 | -79 | 64 | 206 | 349 | 491 | 634 |
| 350 | -46 | 121 | 289 | 456 | 624 | 791 | 959 |
| 400 | 129 | 321 | 514 | 706 | 899 | 1,091 | 1,284 |
| 450 | 304 | 521 | 739 | 956 | 1,174 | 1,391 | 1,609 |
| 500 | 479 | 721 | 964 | 1,206 | 1,449 | 1,691 | 1,934 |
| 550 | 654 | 921 | 1,189 | 1,456 | 1,724 | 1,991 | 2,259 |
| 600 | 829 | 1,121 | 1,414 | 1,706 | 1,999 | 2,291 | 2,584 |

NET RETURNS PER ACRE ABOVE **TOTAL COSTS** FOR SUPER-HIGH DENSITY OLIVES FOR OIL

| PRICE (DOLLARS/TON) | YIELD (TONS/ACRE) | | | | | | |
|---|---|---|---|---|---|---|---|
| Olives for Oil | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | 6.5 |
| | $/Acre | | | | | | |
| 300 | -1,277 | -1,134 | -992 | -849 | -707 | -564 | -422 |
| 350 | -1,102 | -934 | -767 | -599 | -432 | -264 | -97 |
| 400 | -927 | -734 | -542 | -349 | -157 | 36 | 228 |
| 450 | -752 | -534 | -317 | -99 | 118 | 336 | 553 |
| 500 | -577 | -334 | -92 | 151 | 393 | 636 | 878 |
| 550 | -402 | -134 | 133 | 401 | 668 | 936 | 1,203 |
| 600 | -227 | 66 | 358 | 651 | 943 | 1,236 | 1,528 |

Table 8.

UC COOPERATIVE EXTENSION
COSTS and RETURNS/BREAKEVEN ANALYSIS
SACRAMENTO VALLEY – 2004
ARBEQUINA VARIETY

| Crop | 1. Gross Returns | 2. Operating Costs | 3. Net Returns Above Oper. Costs (1-2) | 4. Cash Costs | 5. Net Returns Above Cash Costs (1-4) | 6. Total Costs | 7. Net Returns Above Total Costs (1-6) |
|---|---|---|---|---|---|---|---|
| Olives for Oil | 2,250 | 911 | 1,339 | 1,294 | 956 | 2,349 | -99 |

## COSTS AND RETURNS - TOTAL ACREAGE

| Crop | 1. Gross Returns | 2. Operating Costs | 3. Net Returns Above Oper. Costs (1-2) | 4. Cash Costs | 5. Net Returns Above Cash Costs (1-4) | 6. Total Costs | 7. Net Returns Above Total Costs (1-6) |
|---|---|---|---|---|---|---|---|
| Olives for Oil | 67,500 | 27,344 | 40,156 | 38,810 | 28,690 | 70,482 | -2,982 |

## BREAKEVEN PRICES PER YIELD UNIT

| CROP | Base Yield (Units/Acre) | Yield Units | Breakeven Price to Cover | | |
|---|---|---|---|---|---|
| | | | Operating Costs | Cash Costs | Total Costs |
| | | | $ per Yield Unit | | |
| Olives for Oil | 5.0 | Ton | 182.29 | 258.73 | 469.88 |

## BREAKEVEN YIELD PER ACRE

| CROP | Yield Units | Base Price ($/Unit) | Breakeven Yield to Cover | | |
|---|---|---|---|---|---|
| | | | Operating Costs | Cash Costs | Total Costs |
| | | | Yield Units/Acre | | |
| Olives for Oil | Ton | 450 | 2.0 | 2.9 | 5.2 |