

Timing Manzanillo olive harvest for maximum profit

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The California black or green "ripe" olive is processed from a horticulturally immature fruit. The firm fruit desirable for this process are obtained by beginning harvest when the olive skin color changes from green to pale green or straw color and lenticels (breathing pores) become less prominent. Manzanillo olives remain firm enough for the California ripe process for four to eight weeks after the initial color change, until red skin coloration penetrates the flesh. Color penetration into the flesh occurs slowly when crops are heavy and rapidly when they are light. In the southern San Joaquin Valley, Manzanillo olive harvest can begin as early as September 1 and continue until as late as November 15.

To maximize income, California olive growers strive to produce the highest possible yield of high-value fruit. In addition to good cultural management throughout the growing season, harvest timing can substantially affect tonnage and quality of the crop. With the Mission olive, approximately 20 percent of the potential weight develops during October, at mid-harvest (fig. 1). Fruit size increases simultaneously because of increasing moisture content. Similar changes are believed to occur in seasonal growth of the Manzanillo olive.

As individual fruit weight increases, tonnage per acre increases. Increasing fruit size also raises fruit value substantially, because larger fruits are more valuable than smaller ones (table 1). Our study, conducted during the 1984 and 1985 olive harvest season, quantified changes in Manzanillo fruit weight and value and assessed the effect on income per acre when olive harvest deviates from an optimum time.

Methods

We used a large orchard of mature Manzanillo olive trees (1971 planting) in Madera spaced 15 by 30 feet, resulting in 96 trees per acre.

In each year, 90 uniformly cropped trees were selected to be harvested for the total test. Because of the alternate



Petite and undersize olives are worth little and may not even pay picking costs that commonly exceed \$200 per ton. Harvest timing can reduce the percentage of the crop in these sizes.

bearing characteristic of olive, we attempted to achieve uniformity of cropping between years by using a separate block of trees each season. Beginning at the first practical time for harvest (change in fruit color), 10 trees were individually harvested each week for eight weeks (nine harvest dates). The final harvest week was the last in which olive harvest would be practical because of the frost hazard in this district. In 1984, harvest began on September 17 and continued through November 12. The 1985 harvest was from September 16 to November 11. Each of the nine harvest dates (treatments) was arranged in a randomized complete block design of 10 replicates (trees).

Total harvest weight for each tree was recorded, and a fruit sample of approximately 10 pounds was separated and submitted to Bell Carter Olive Company for quality analyses, conducted by U.S. Department of Agriculture olive inspectors.

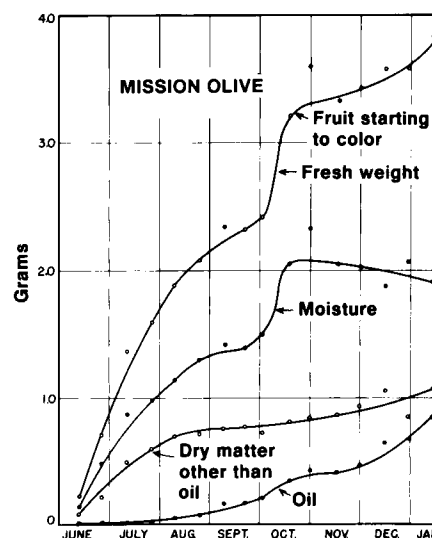


Fig. 1. Manzanillo olives, like the Mission variety, achieve 20 percent of potential weight and size during October.

TABLE 1. Manzanillo olive grades and value, Bell Carter Foods, Orange Cove, California

Size grade*	Count per pound	Value per ton	
	range	1984	1985
		\$	\$
Extra large	72 - 80	535	580
Large	89 - 105	535	580
Medium	106 - 121	525	550
Standard (small)	128 - 140	400	435
Petite (limited use)	141 - 180	200	250
Subpetite/ Undersize/Culls	181 - up	10	10

* Petite fruit are limited in use to chopped and sliced olives. Subpetite and undersize fruit can be used only for Spanish olives or oil products. Cull fruit can be used only for oil products.

Upon delivery, the entire sample was reweighed and the fruit separated into the size categories, as specified by the Federal Marketing Order for Manzanillo olives, of undersize, petite, standard, medium, large, and extra large. Weight of each segment was recorded and percent of the total sample calculated. Weight and percentage of cull fruit (damaged and overripe, black fruit) were also determined. The composite value of the total crop from each tree was determined from these analyses using the Bell Carter Foods 1984 and 1985 pricing schedule (table 1). Individual tree weights and values were used to calculate value per ton, yields per acre, and gross per acre value of the crop.

Yield

On the first harvest date, September 17, 1984, an average of 83.5 pounds of fruit was harvested per tree. On October 29, the average yield was 134.5 pounds per tree, a 61.1 percent increase. As fruit matured during the eight-week harvest season, a trend of increasing weight occurred throughout the first six weeks of harvest, and total weight per tree significantly improved in the second week of October (table 2). No significant difference in yield occurred after October 29.

Yields per tree in 1985 were not significantly different between harvest dates because of a variability in crop size within test trees. As in 1984, however, a trend of increasing yield was evident during the first three weeks of harvest; on September 16, the first harvest date, an average of 144.2 pounds of fruit was harvested per tree, increasing to 192.6 pounds per tree on October 7, a 33.6 percent increase.

Fruit size

Undersize and petite. Olive picking costs commonly exceed \$200 per ton. Petite fruits are often worth less than that, and undersize olives are virtually worthless, with a value of \$10 per ton. The percentage of the crop in these sizes thus greatly affects the net value (after picking) to the grower.

TABLE 2. Effect of harvest date on weight of Manzanillo olives, Madera, California

Harvest date	Crop weight per tree	
	1984	1985
<i>Mo./1984-85</i>	<i>lb.</i>	<i>lb.</i>
9/16-17	83.5 a	144.2 a
9/23-24	84.2 a	153.2 a
9/30-10/2	107.4 abc	164.4 a
10/ 7- 8	94.2 a	192.6 a
10/14-15	124.1 cd	178.4 a
10/21-22	121.8 bcd	164.0 a
10/28-29	134.5 d	144.1 a
11/ 5- 6	106.4 bcd	159.4 a
11/11-12	105.1 bcd	162.6 a

* Data are means of 10 replicates per harvest date. Means with a common letter are not significantly different at the 5% level.

TABLE 3. Percentage of Manzanillo olives in USDA fruit size categories and resulting value per ton, Madera, California

Harvest date	Culls*		Size category						Value per ton
	Damaged	Over-ripe	Under-size					Extra large	
				Petite	Standard	Medium	Large		
	%								\$
1984									
9/17	.0 a	.0 a	35.1 a	40.6 a	17.7 a	5.7 a	.9 a	.1 a	199.90 a
9/24	.4 a	.0 a	30.8 a	38.2 a	21.9 ab	7.3 a	1.0 a	.4 a	223.40 a
10/1	2.5 a	.0 a	26.5 a	26.5 b	28.7 bc	11.9 ab	3.3 ab	.5 a	263.50 bc
10/8	.7 a	.0 a	6.4 b	25.0 b	27.6 bc	22.1 bc	11.2 c	7.1 a	393.90 de
10/15	.9 a	.0 a	4.6 b	12.3 c	33.4 c	32.2 d	13.3 c	2.3 a	437.10 e
10/22	1.0 a	.1 a	5.1 b	15.8 c	32.2 c	34.8 d	10.0 b	1.0 a	422.60 e
10/29	.1 a	3.0 ab	8.7 b	17.8 ab	33.5 c	25.0 bc	9.5 bc	2.5 a	400.50 e
11/5	.4 a	6.1 b	4.3 b	12.0 c	31.1 c	31.9 d	11.7 c	1.5 a	412.80 e
11/12	.4 a	10.8 c	4.7 b	15.5 c	27.3 bcd	29.8 bcd	10.0 c	1.6 a	370.40 d
1985									
9/16	.0 a	.0 a	25.5 a	33.4 a	21.3 a	12.7 a	7.5 a	.0 a	278.20 a
9/23	.4 a	.0 a	21.9 a	28.4 a	23.8 a	17.3 a	6.8 a	1.4 a	335.10 abc
9/30	.5 a	.0 a	20.1 a	24.6 ab	25.8 a	19.5 a	8.3 a	1.2 a	349.10 abcd
10/7	1.3 a	.4 a	15.4 ab	27.3 a	25.9 a	16.5 a	8.2 a	5.1 a	367.90 abcd
10/14	.8 a	.8 a	10.7 ab	15.6 ab	21.5 a	23.9 a	17.5 bc	9.6 ab	441.50 def
10/21	.6 a	6.5 b	5.0 ab	9.0 c	15.9 a	22.0 a	18.4 c	22.8 c	475.10 f
10/28	.6 a	10.9 d	3.6 b	6.5 c	13.6 a	20.1 a	20.9 c	24.0 c	468.90 f
11/4	.8 a	8.1 c	6.2 b	12.2 c	18.7 a	20.9 a	17.4 bc	15.8 bc	441.30 def
11/11	14.6 a	12.3 e	8.3 b	13.0 c	15.8 a	16.2 a	9.9 ab	9.9 ab	324.60 ab

NOTE: Figures are averages of ten 100-ounce samples. Percentages rounded to nearest tenth. Mean separation by Duncan's multiple range test; figures with the same letter within each column are not significantly different from each other at the 5% level.

* Culls separated into Damaged and Blacks (Overripe)

In both years, percentages of undersize and petite olives declined as harvest was delayed, and the decline was significant in the latter part of September and during October (table 3). Although no further significant change occurred in either of these size grades during the last three to five weeks of this harvest, the decreasing trend continued (fig. 2).

Standard and medium. In 1984, the standard and medium size grades increased significantly in late September and early October, as smaller fruit at earlier harvests enlarged when left on the tree. After October 1, no further increase in quantity of standard and medium-size fruit occurred as fruit continued to enlarge to other size grades.

In 1985, a higher yielding crop year, the percentage of fruit in the standard category declined, while the percentage of medium-size fruit increased as harvest

was delayed. The changes were not significant in either category.

Fruit enlargement from the smaller (undersize and petite) sizes into these grades represents a substantial improvement in value per ton and thus income per acre.

Large and extra large. In both 1984 and 1985, the percentage of fruit in the large size category increased significantly by the fifth harvest date. No further significant improvement occurred throughout the period.

In the higher yielding 1985 crop year, the percentage of extra large fruit improved significantly in the week of October 21. Since a higher yielding olive crop is known to mature later, such size changes may also occur later.

Culls. Overripe fruit, which have the dark purple color of mature olives penetrating the flesh, are a major concern

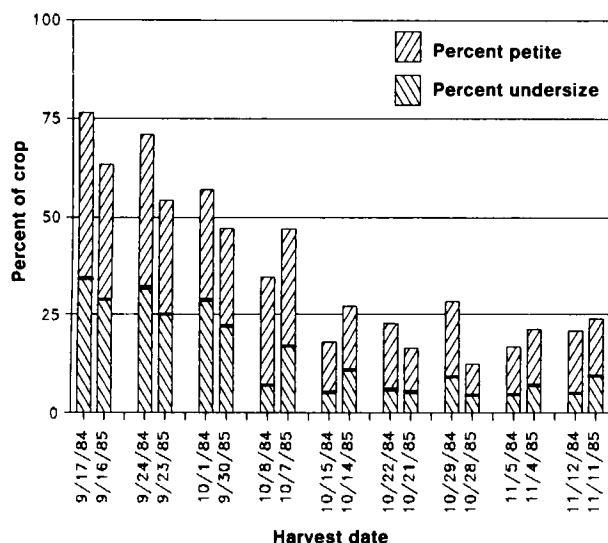


Fig. 2. Percentages of low-value petite and undersize Manzanillo olives declined as harvest season progressed.

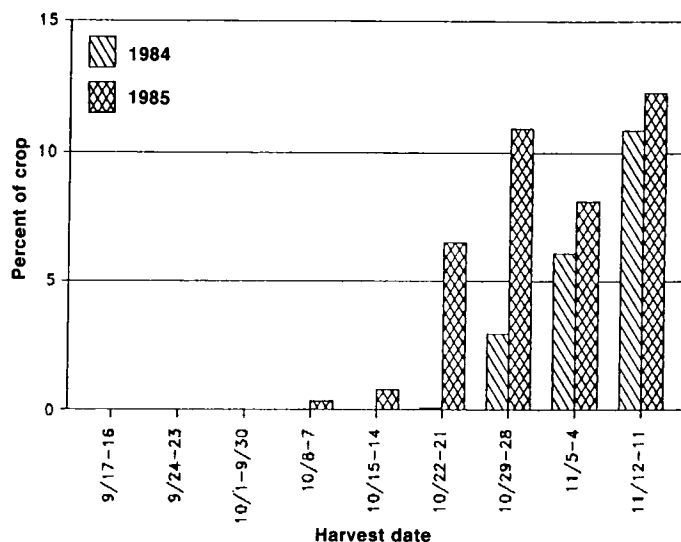


Fig. 3. Unlike the trend in fig. 2, the percentage of overripe olives increased as the end of the harvest season approached.



The most desirable stage of maturity for 'ripe' olives is when the skin color changes from green to pale green or straw color. As olives become darker and red skin coloration penetrates the flesh, the fruit become undesirable for processing as ripe olives. The 'milk stage' (below) is the earliest measure of maturity for the 'California ripe olive' process.



when delaying harvest. Cull fruit (including both physically damaged and overripe) have the same value as undersize olives.

In 1984, the overripe portion of cull fruit increased significantly in the first week of November. In 1985, cull fruit significantly increased by October 21, and significant increases occurred each week thereafter. In both years, most culls were overripe, black fruit (fig. 3).

Value per ton

In both 1984 and 1985, the increase in fruit value paralleled fruit size increase.

In 1984, value per ton increased significantly during the latter part of September and early October. The increase in value between the first harvest date and the date of optimal value, October 15, averaged \$237 per ton. Value decreased significantly on the last harvest date, November 12, because the number of overripe fruit was significantly higher.

In 1985, value per ton also increased significantly but did so later in the harvest season, between the third and fourth harvest dates. Optimal value, attained on October 28, was approximately \$190 per ton higher than at the first harvest. On the last harvest date, November 11, fruit value had significantly decreased from the optimum to approximately the value of the second harvest date, September 23. This change also reflects the significant increase in overripe cull fruit.

Conclusions

Manzanillo olives gain a substantial percentage of their potential weight during late September and early October, the harvest period for the California "ripe"

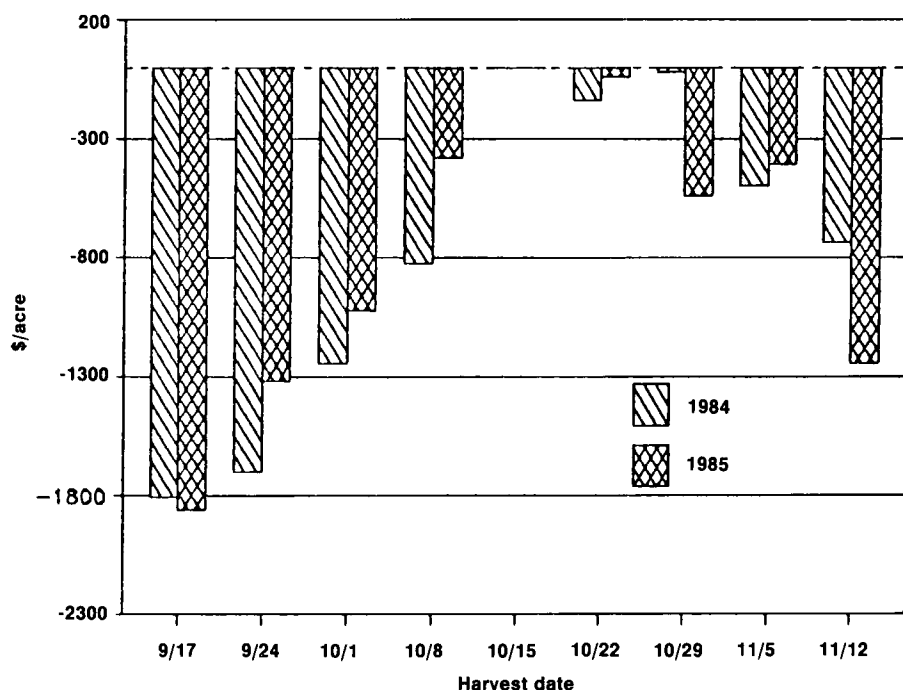


Fig. 4. A substantial loss in value per acre resulted from harvesting olives before or after they reached optimum weight and size (on Oct. 15, 1984, and Oct. 14, 1985).

olive. The fruit also enlarge dramatically during this period, increasing the crop value. These increases in yield per acre and value per ton affect income per acre. There is a financial penalty for harvesting before maximum tonnage and value have developed or after olives become overripe (fig 4.).

Choosing the optimum harvest date requires careful thought. To avoid substantial fruit and income loss, the grower must consider: (1) labor availability, (2) capability of the processor to handle an increased crop in less time, (3) crop size and rate of development of cull fruit, (4) influence of soil type on crop maturity, and (5) early fall frost hazard. Understanding the parallel changes in fruit weight and size that occur during the fall, however, and using the information to determine harvest dates will help maximize profit.

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Publications of interest

IPM manuals

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