Optimum Time for Olive Harvest

fruit size and texture at harvest have important influence on the quality of black-ripe and green-ripe processed olives

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Studies conducted for three years, with several varieties of olives, were designed to determine the stage of fruit maturity at harvest that would result in the highest quality of black-ripe and green-ripe processed fruit.

Taste panel evaluations found that the texture of processed olives was closely correlated with the texture of raw fruits. Texture of both the raw fruits and the subsequent processed fruits became softer as time of picking was delayed. In black-ripe olives, intensity of dark color decreased in processed fruits as the date of harvest advanced. The intensity of olive flavor or off-flavors in the processed olives was less affected by fruit maturity at harvest than were texture and color.

Fruit size and texture are the two most important factors in judging the optimum time to harvest olives. Harvest should be delayed as long as possible to obtain the maximum fruit size and the maximum flesh-pit ratio, yet not so long as to produce processed fruit with an unacceptably soft texture.

Studies in 1956

Samples of Manzanillo, Mission, and Sevillano olives were harvested on the dates listed in the table.

Texture firmness values were obtained with a texture meter from samples of 36 grams of olive flesh. The texture meter indicates the pounds of force required to push a set of 25 four-millimeter plungers through a sample randomly placed in a metal cup.

The fruit samples were processed by the black-ripe method without previous brine storage and then canned by commercial canning procedures.

In May, 1957, a brief survey-type quality evaluation was made on the canned samples. Six to ten persons with training and experience in evaluating olives scored the samples for texture, intensity of olive flavor, and off-flavors. Each varietal series was scored independently. The judges scored the samples in individual tasting booths equipped with low red illumination to minimize the effect of any color differences among the samples on scoring the other factors.

With all three varieties—Manzanillo, Mission, and Sevillano—the texture meter values steadily decreased as the raw fruits matured, indicating a softening of the flesh. These values correlated very well with the taste panel texture evaluations, which also showed a uniform decrease in hardness of the flesh of the processed fruit with advancing maturity of the fruit at harvest. Flavor and off-flavor evaluations were not strongly correlated with stage of maturity at harvest, although the presence of olive flavor did tend to increase somewhat in the Manzanillo and Mission varieties with advancing fruit maturity. This was not true for the Sevillano variety.

Studies in 1957

Fruit samples of Manzanillo, Mission, and Sevillano olives were harvested as in 1956 on the dates given in the graphs. Measurements were made of fruit weight, pit weight, and percent classed as green, straw, red, or black. In addition, oil content of the fruit was determined. Texture meter evaluations were made as in the earlier studies. The entire 50-pound sample was graded into commercial size grades from which a size index was calculated.

Immediately after harvest, all samples were stored in brine for about 130 days until they were processed by the black-ripe method. Chemical treatment to influence color development was avoided purposely. After processing, the samples were canned according to commercial practices.

About 60 days after processing, subjective quality evaluations were made by the panel of judges who scored the olive samples the previous year. Besides scoring for texture, flavor, and off-flavors, the panel scored the olives for color—very light to very dark—under a standard light source.

In preparing the fruit for analysis each day, three to six cans of each sample—depending on variety—were combined and then randomly divided for panel testing and texture measurements.

Fruit weight, volume, and oil content determinations were made on samples of processed and canned fruits. Measure-

Effect of Time of Harvest on Quality of Canned Black-ripe Olives. Harvested at Winters

Variety	Harvest dates 1956	Texture meter measurements of raw fruit	Taste panel evaluation of processed fruit		
			Texture[a]	Flavor[b]	Off-flavor[c]
Manzanillo	Sept. 6	160	+3.50	2.50	2.75
	Sept. 22	143	+2.25	3.25	1.75
	Oct. 4	124	+2.00	3.25	1.75
	Oct. 12	120	+1.00	3.75	2.25
	Oct. 19	123	+0.75	4.50	1.50
	Nov. 1	91	0.00	5.50	1.50
	Nov. 13	73	−0.25	5.00	1.50
	Nov. 20	65	−0.50	4.25	1.00
	Nov. 29	..	−0.50	5.25	1.50
Mission	Sept. 16	193	+3.40	2.60	3.00
	Sept. 22	172	+2.40	2.60	2.60
	Oct. 4	154	+2.00	3.60	1.80
	Nov. 1	100	0.00	3.40	1.60
	Nov. 20	69	−0.20	3.40	2.20
	Nov. 29	..	0.00	4.40	2.00
Sevillano	Sept. 6	152	+2.40	3.00	1.80
	Sept. 22	150	+1.20	4.00	2.20
	Oct. 4	122	+1.40	3.80	2.00
	Nov. 1	116	+0.80	3.40	1.80
	Nov. 20	57	0.00	2.40	2.80
	Nov. 29	..	−0.60	2.00	3.80
r^d		+0.92			

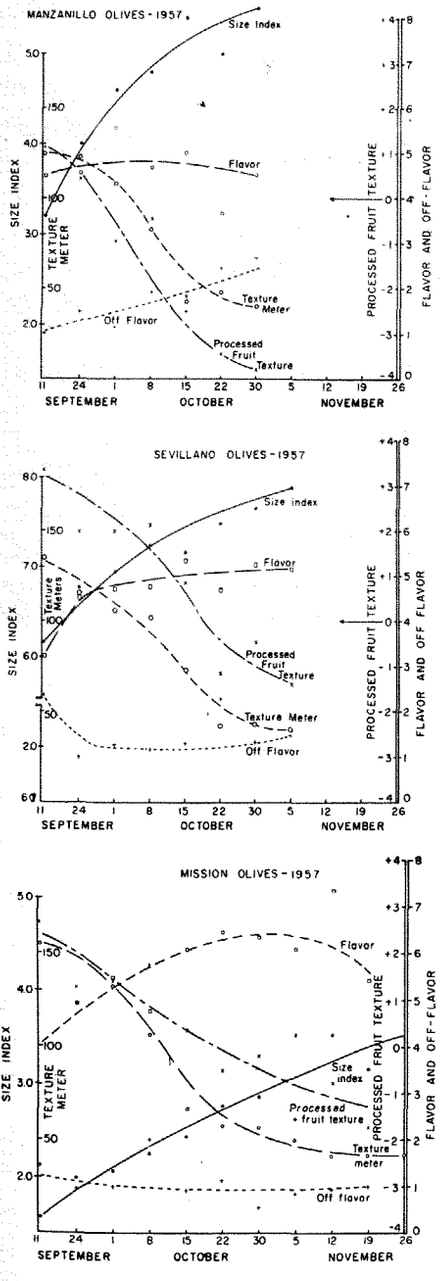
[a] 0 = optimum; +4 = hard; −4 = soft.
[b] 10 = high in ripe olive flavor; 1 = no ripe olive flavor.
[c] 5 = intense; 0 = none.
[d] Correlation coefficient with panel texture scores.

ments were also made of the percentage of shriveled fruits.

As in 1956, the principal relationship that appeared was between fruit maturity and fruit texture, both before and after processing. Fairly uniform decreasing values were obtained with the texture meter, indicating that a softening of the flesh occurred with increasing maturation.

Flavor and off-flavor were only slightly related to the maturity stage at harvest although flavor in the Mission variety tended to increase with advancing fruit maturity, as in the 1956 studies.

Some characteristics of raw and processed Manzanillo, Sevillano, and Mission olive fruits harvested at weekly intervals during the 1957 season. The texture meter and size index curves refer to raw fruit at harvest. The flavor, off-flavor, and processed fruit texture curves apply to processed and canned fruits.



In all three varieties the processed fruits definitely changed from a dark to a lighter color as the harvest date advanced.

Fruit size increased steadily throughout the harvest period, exclusively from flesh enlargement, since the pit size remained unchanged. The flesh-pit ratio therefore increased constantly with increasing fruit maturity. The density of both fresh and processed fruits decreased slightly with advancing maturity, presumably because of accumulation of oil in the fruits.

The percentage of shriveled fruits after processing and canning was apparently unrelated to harvest date, but differences were noticeable among varieties. An average of only 2% of Manzanillo, and 5% of Mission fruits showed shrivel while this occurred in 25% of the Sevillano fruits.

Oil content increased with maturation in the fresh fruit of all three varieties. The oil content was not materially different after processing and canning from that found in the fresh fruit.

Studies in 1958

Studies were continued with the Mission, Manzanillo, and Sevillano varieties but processing was done by the green-ripe method. The Ascolano variety, omitted in earlier tests, was included but processed by the black-ripe method.

Also in the 1958 studies, the texture meter was tested for its value in field use to determine the optimum maturity stage for harvest. Mission, Manzanillo, and Sevillano fruit samples were harvested at weekly intervals from a representative tree in each of the major olive districts, and shipped to the laboratory where texture meter readings were made. When the fruit texture dropped to a level which —according to data obtained in 1957— would result in processed fruit of optimum texture, 50-pound fruit samples were picked for black-ripe processing. After processing, the canned samples were evaluated by the judges who scored the fruit in the previous studies.

Harvest maturity apparently is a more important factor affecting flavor and off-flavor when the olives are processed as green-ripes than when processed as black-ripes. However, texture in green-ripes was still the most important characteristic affected by harvest maturity. In general, the olives which had reached an optimum texture, as indicated by the texture meter, were the most flavorful and least off-flavored. In an attempt to subjectively evaluate the effect of maturity on appearance of green-ripe olives, the panel compared the samples with a standard color plate for color and reflectance. There was a significant tendency for the samples to approach the standard medium yellow—MY—from green to yellow with increasing maturity. In all of the studies the texture meter readings and laboratory panel texture scores correlated to a highly significant degree.

The effect of harvest maturity on Ascolano processed black-ripe olives was very similar to that found in 1957 with the other varieties. There was a statistically significant increase in tenderness, and a decrease in dark color, with little or no effect on flavor and off-flavor, as the harvest maturity progressed.

Comparisons of Sevillano, Mission and Manzanillo olives harvested from the three major olive districts and processed as black-ripes revealed no differences in olive flavor or off-flavor attributable to the district variation. All these samples were harvested according to the recommended texture meter values —110 for Manzanillo, 75 for Mission, and 60 for Sevillano. The resulting processed fruits were very close to the texture value considered optimum by the panel judges.

Selecting Harvest Time

According to these studies, texture of the processed olives seems to be the most important attribute of fruit quality which is highly correlated with the stage of fruit maturity at harvest, although color of the processed fruit also is significantly affected by maturity. Intensity of olive flavor and the development of off-flavors, especially in black-ripe olives, are much less affected by fruit maturity than are color and texture.

Fruit size and texture of the processed fruits are apparently the two factors that should determine the optimum time to harvest. It is to the grower's advantage to allow the fruits to remain on the tree as long as possible, to obtain the considerable premium paid per ton for the larger fruits. In addition, the pronounced increase in the flesh-pit ratio associated with the larger fruits results in a product much more desirable to the consumer. On the other hand, the fruit becomes increasingly soft as it matures on the tree and finally reaches a point when— if harvested beyond that stage—an unpalatably soft product will result. Therefore, the ideal harvest time is the stage when the fruit has reached the maximum possible size consistent with a texture that will not be unacceptably soft in the finished product.

Most olive processors attempt to produce olives as black as possible, believing that this is desired by the consumer. Color of the processed olives becomes lighter as maturity of the raw fruit advances. This, then, is a factor in favor of early harvest. It would seem, however,

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SWINE

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At the end of each replicate, TDN—total digestible nutrients—were determined. The results are summarized in the table in the second column on this page. Stage of maturity and method of preparation had no effect. Since alfalfa was added to the two higher levels at the expense of barley, the relative TDN of barley and alfalfa can be estimated by difference under the conditions of this experiment. In this experiment the average TDN of all alfalfa meals was 34 pounds less per hundred pounds than barley. This would be expected due to the low utilization of holocellulose by simple-stomached animals.

Average Daily Feed Consumption Pounds[a]

Level Alfalfa	Preparation	Stage of alfalfa maturity 16% bud	3% bloom	34% bloom
	Suncured	6.28	6.53	6.60
5%	Dehydrated	6.88	6.03	6.36
	Pelleted*	6.12	6.40	6.06
	Suncured	5.35	5.43	5.60
20%	Dehydrated	6.03	4.93	5.56
	Pelleted*	6.13	5.51	5.80
	Suncured	4.11	4.18	4.37
40%	Dehydrated	4.06	2.52	3.93[b]
	Pelleted*	3.68	3.71	3.64

	Summated means	Actual
	5% alfalfa	6.36
Level	20% alfalfa	5.59[c]
	40% alfalfa	3.80[c]
	16% bud	5.40
Stage	3% bloom	5.03
	34% bloom	5.32
	Suncured	5.38
Preparation	Dehydrated	5.15
	Pelleted*	5.23

*Pelleted, dehydrated, reground.

[a] Averages for 3 animals, one for each replicate.

[b] Animal missing first replicate. Missing value calculated.

[c] Difference from other levels highly significant.

Total Digestible Nutrients of Various Rations[a] Dry matter basis, percent

Level Alfalfa	Preparation	Stage of alfalfa maturity 16% bud	3% bloom	34% bloom
	Suncured	70	76	73
5%	Dehydrated	71	75	73
	Pelleted*	75	76	75
	Suncured	65	69	70
20%	Dehydrated	71	65	66
	Pelleted*	68	66	67
	Suncured	59	63	60
40%	Dehydrated	71	61	60
	Pelleted*	61	61	60

	Summated means	Actual
	5% alfalfa	74
Level	20% alfalfa	67[b]
	40% alfalfa	62[b]
	16% bud	68
Stage	3% bloom	68
	34% bloom	68
	Suncured	67
Preparation	Dehydrated	68
	Pelleted*	68

* Pelleted, dehydrated, reground.

[a] Averages for 3 animals, one for each replicate.

[b] Difference from other levels highly significant. F value for level = 36.02.

The replacement value of alfalfa meal as used in this experiment was calculated using average daily gain figures adjusted to an average daily feed consumption of 5.25 pounds by partial regression. Adjusted data were used because it reduces variation due to differences in feed consumption and presumably would reduce differences due to composition of gain. Using feed utilization comparisons between the 5% and 20%, 5% and 40%, and 20% and 40% alfalfa meal levels, the replacement values were 0.24, 0.28, and 0.31 pound of concentrate per pound of alfalfa meal. This averages 0.28 pound of concentrate being replaced by one pound of alfalfa meal. This low replacement value is considerably less than would be predicted from commonly accepted TDN or net energy values of the ration ingredients involved and alfalfa meal.

Poor performance and a low TDN generally would be expected on a high roughage ration for swine. No reason can be advanced for the relatively good performance in some experiments. Quality of hay probably is important even though the quality of alfalfa used in these trials appeared excellent. Quality of hay as indicated by stage of maturity and method of preparation under the conditions of this experiment was of little or no effect. It has been suggested that breed and selection may play a part in utilization of higher levels of alfalfa meal.

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APPLE

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grown. In view of the distinctly greater tendency for reversion in the striped types—as compared to the solid red types—sports with the solid red color are preferred for districts, such as Watsonville, where conditions for good red color development are not usually optimum. Even with these sports, however, the scion wood should be selected with care, since—as shown with Richared Delicious—reversion may occur in these types.

A large number of sports of Delicious have been discovered in recent years and are being propagated. Most of those which are available to growers through nurseries are being tested in the several apple districts of California where Delicious is grown. Among these sports, Royal Red Delicious, Starkrimson Delicious, Wellspur Delicious, Redspur, Ryan Red, Houser Red Delicious, and Imperial Delicious have a solid red color. Red King Delicious, Hi-Early, Earlired Red Delicious, Hi-Red, Topred Delicious, and Clarkrich are striped types. The trees of Starkrimson Delicious, Wellspur Delicious, and Redspur are also heavy spur producers and tend to be somewhat smaller than those of the other sports.

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OLIVE

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that the characteristics of larger fruit size, increased flesh-pit ratio, and an optimum processed fruit texture should far offset the single advantage of early harvest to produce a black rather than a brown olive, especially since the better quality characteristics are more likely to be associated with brown olives than with black olives.

The present study does not entirely support the belief that olive fruits with a high oil content have a better flavor than fruits low in oil. In Manzanillo and Sevillano, the more highly colored fruit at harvest had a greater oil content, but no greater olive flavor in the processed fruit. Flavor ratings were essentially the same for Manzanillo fruits, with an oil content average of 11.6% and for Sevillano fruits, with an oil content average of 8.4%.

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