PROCEDURES FOR THE EVALUATION OF SEVERAL KINDS OF SPANISH-TYPE FERMENTED GREEN OLIVES[1]

by
J. L. Etchells, I. D. Kittel[2], R. E. Kelling, T. A. Bell, R. J. Monroe, and H. P. Fleming

North Carolina Agricultural Experiment Station, Departments of Food Science and Experimental Statistics, North Carolina State University, Raleigh, 27607; Food Fermentation Laboratory, U.S. Department of Agriculture, Agricultural Research Service, Southern Region; and, M. A. Gedney Company, Chaska, Minnesota 55318, USA[3]

STATEMENT

"This paper presents information based on nine years of work and sampling various types of Spanish-type, fermented green olives. The work has included examination of about 340 casks of imported olives as they arrived in the USA, plus a large number of pure culture fermentations, as well as olive products purchased at retail stores. The research explores areas of receiving and examination of imported olives and presents new ideas and data forms never before offered or summarized in this fashion. It should be of significant assistance to quality assurance personnel and their supervisors. Also, it should be mentioned that one of the authors has made four trips to the olive brining areas in Spain (Seville area) to gain first-hand information on the brining, handling, shipping, and other aspects of this industry, as it relates to exporting to the USA."

W. R. Moore, Jr.
Executive Vice President
Pickle Packers International, Inc.
St. Charles, Illinois 60174

---

[1]Paper no. 4456 of the Journal Series of the North Carolina Agricultural Experiment Station, Raleigh.

[2]Formerly with M. A. Gedney Company when work reported herein was done. Present address: Vlasic Food Products, Inc., West Bloomfield, Michigan 48033.

[3]Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or North Carolina Agricultural Experiment Station, nor does it imply approval to the exclusion of other products that may be suitable.

CONTENTS[4]

[4]Information contained herein represents quality evaluation data that, as presented, could be considered a supplementary or companion paper to the publication, "The FFL Olive Pressure Tester: An Instrument for Measuring the Firmness of Spanish-Type Green Olives," by Etchells, Kittel, Kelling, Bell, Monroe, and Fleming. The latter paper, by invitation, was prepared for, and presented at, the "IV International Congress of Food Science and Technology," September 23-27, 1974, in Madrid, Spain. It has since been published in the Spanish journal, "GRASAS Y ACEITES" (Seville), volume 26, pages 139-146, 1975, in the English language.

[5]Detailed evaluation sheets not shown.

INTRODUCTORY REMARKS

It is the objective of the present work that we may be able to help quality assurance workers, as well as officials in control of such programs, with procedural information for determining quality evaluation of various kinds of Spanish-type fermented olive products. Our procedures have been developed over a nine-year period; also, they have been based on the simultaneous firmness and sensory observations, together with certain chemical tests on the brines, and other physical tests, on nearly 340 casks of imported olives. Also included, were a similar number of lots of experimentally brined olives, using our pure culture technique; U.S. Patent No. 3,480,448 (1969). Retail olive products have also been examined.

REPORT: The present report, consisting almost wholly of tabular material, is important in order to give the quality control personnel a clear-cut idea of the overall quality of olive products; particularly those imported in bulk, or repacked for retail sale.

We first found it necessary to develop meaningful procedures, including an olive pressure tester amenable to statistical analysis. This has been done (Etchells et al., 1975; see footnote 4, under "Contents" for important information about this reference.) The "Overall Quality Ratings for Commercial Use," are the same that we have used for cucumbers for many years. This "Quality Rating Scale . . ." is given at the bottom of each evaluation sheet presented. The "Firmness Rating Scale for Whole Olives," using the no. 4 plunger of our olive texture tester (Etchells et al., 1975) is among the descriptions and citations to other tests presented in the reference just mentioned.

Even so, because of its importance to the reader, the "Firmness Rating Scale for Whole Olives Using the no. 4 Plunger," is given here:

Values in Grams (g)	Firmness Ratings and Remarks
175 g and below	= **Soft;** not or barely acceptable
176 to 200 g	= **Inferior;** not good texture, but acceptable
201 to 250 g	= **Firm;** acceptable
251 to 325 g	= **Very firm;** acceptable
326 g and above	= **Very firm** to hard; probably too firm; bordering on a tough reaction when bitten and/or chewed

The remarks on the various ratings are included here as they are considered essential for the purposes intended, namely, for effective quality control evaluations.

We have also reproduced herein copies of completed rating sheets representing the *actual* examination and evaluation techniques for several kinds of olive products. This has been done to give the quality control personnel a clear and detailed insight into procedures we use in our routine examination and evaluation of various types of olive products.

At the outset, a brief summary (Table 1, PART I) has been included to show the quality control worker what normally might be shown him as to quality evaluation of five types of olive products. However, each of these exhibits listed in the Table (except the last two) refers to an *actual examination from an evaluation sheet*—thus, the reader can refer to the appropriate sheet and readily see how the final rating was obtained, together with the reasons given for the decision made by the judges.

Further, summarized information is included for a single shipment of 29 casks of imported olives, *including brine-loss* from the casks during shipment. Also, summarized information on the evaluation of nine shipments of imported casks of olives (339), covering a nine-year period of study, is presented. Finally, notes on receiving imported olives, based on discussions with importers in the southeastern United States, are reported.

SUMMARY. It is our desire that the information presented by Etchells *et al.* (1975), as well as that given herein, will be useful in developing and maintaining high quality table olives with benefits to grower, briner, bottler, and consumer alike! It is also our desire, that quality control personnel, and their supervisors, will have available the paper on the "Olive Pressure Tester, published in the English language in the journal, "Grasas Y Aceites" (Seville, Spain), when they study the material contained herein.

Both of these papers will be available from the authors, or from W. R. Moore, Jr., Executive Vice President, Pickle Packers International, Inc., St. Charles, Illinois 60174, USA.

Finally, the authors wish to thank the many persons that have helped us in the preparation of this portion of the "Olive Study . . ." They have been acknowledged in detail in the companion paper on the "Olive Pressure Tester . . ." referred to earlier.

PART I: Table 1

Table 1. Quality evaluation of different kinds of Spanish-type green olives.

Kind of Spanish-type green olives and source of sample	No. of samples	Rating sheets labelled as:	Overall commercial acceptability rating
		Exhibit[1]	Numerical[2]
Whole, green; imported in casks[3]	3	A, B, C	5, 8, 1
Stuffed, green; imported in casks[3]	2	D, E	6, 9
Whole, green; from retail stores	2	F, G	6, 4
Stuffed, green; from retail stores	2	H, I	5, 2
Whole, green; experimental; pure culture fermentation	2	J[4], K (not shown)	1[4], 9

[1]Rating sheets identified as "Exhibits A, B, C, etc." correspond as to individual position of the numerical "Overall Commercial Acceptability Ratings" shown in column 4. (Exhibit sheets "A"-"I")
[2]Overall Commercial Acceptability: 1 = Not Acceptable; 2 = Barely Acceptable; 3-4 = Poor; 5-6 = Fair; 7-8 = Good; 9-10 = Excellent.
[3]These olives, imported in bulk from Spain, were usually shipped in 10, 6 or 3 fanega casks (1 fanega = 16 U.S. gallons).
[4]Not fermented; the species of *Lactobacillus* used *(L. brevis)* grows poorly, if at all, in olive brines, particularly the Manzanilla variety. The olives that received the "9" rating were fermented with *Pediococcus cerevisiae* no. 39.

PART I—EXHIBIT A

Examination of Whole Green Olives, Imported in Casks

Place Exam. *Raleigh, NC* Date Exam. *11/9/67* Date Made _____

Product *Spanish-type, green, whole (bulk) olives* Company *imported* Container Code No. *Lot #III Cask 342*

Treatment *Brined olives, whole, imported in casks*

1. Vacuum or Pressure on Container:

   Vacuum: – Inches Pressure: – Pounds

2. Product Odor: Typical _____ Off *X* *Slightly off odor*

3.

Headspace	Brine	No. Olives	Container Capacity	Solids/Brine Ratio
–	–	–	*Cask*	–

4. Chemical Analysis: Total Acid Stated As:

Turbidity	pH	% Lactic	% Acetic	% Red. Sugars	% Salt
5+ Visual[1]	4.25	0.37	–	0.0	9.5

5. Olive Texture: Size 180/200 /kg Variety Sevillano Plunger Size *#4*
   (20 olives, 2 punctures each)[2]
   Avg. *191* g Sum Total *6485* g Olive Range *100-250* g

6. Appearance: External *Medium green, variable* Internal *Normal*

7. Product Flavor: *A slight off flavor noted*

8. Judges' Scores: *Average of 5 judges = 5*

9. Remarks: *Texture on low side; off flavor*

10. Reason for Rating Given: *Low texture, see above*

11. Overall Commercial Acceptability: (Circle one numeral only)

Not Accept.	Barely Accept.	Poor	Fair	Good	Excellent
1	2	3 - 4	(5) - 6	7 - 8	9 - 10

Exam. by *FFL staff = 5 persons*

[1]Visual turbidity range used: 0 = Clear to 5+ = very heavy.
[2]Only 17 olives available.

PART I—EXHIBIT B

Examination of Whole Green Olives, Imported in Casks

Place Exam. *Raleigh, NC* Date Exam. *1/20/69* Date Made _____

Product *Spanish-type, green whole olives* Company *imported* Container Code No. *Lot #IV, Cask 95*

Treatment *Brined olives, whole, imported in casks*

1. Vacuum or Pressure on Container:

   Vacuum: – Inches Pressure: – Pounds

2. Product Odor: Typical *X* Off _____

3.

Headspace	Brine	No. Olives	Container Capacity	Solids/Brine Ratio
–	–	–	*Cask*	–

4. Chemical Analysis: Total Acid Stated As:

Turbidity[1]	pH	% Lactic	% Acetic	% Red. Sugars	% Salt
Visual OD x 10 *4+ 7.75*	*3.90*	*0.66*	–	*0.02*	*8.24*

5. Olive Texture: Size *240/260* /kg Variety *Sevillano* Plunger Size *#4*
   (20 olives, 2 punctures each)
   Avg. *311* g Sum Total *12425* g Olive Range *250-390* g

6. Appearance: External *Light olive* Internal *Normal*

7. Product Flavor: *Good flavor, salty*

8. Judges' Scores: *Average of 5 judges = 7.8*

9. Remarks: *Good flavor and texture; slightly tough-firm*

10. Reason for Rating Given: *See above*

11. Overall Commercial Acceptability: (Circle one numeral only)

Not Accept.	Barely Accept.	Poor	Fair	Good	Excellent
1	2	3 - 4	5 - 6	7 - (8)	9 - 10

Exam. by *FFL staff = 5 persons*

[1]Optical density of brine read at 650*n*.

PART I—EXHIBIT C

Examination of Whole Green Olives, Imported in Casks

Place Exam. *Raleigh, NC* Date Exam. *6/9/70* Date Made _____

Product *Spanish-type, green, whole olives* Company *imported* Container Code No. *Lot #V Cask 7A*

Treatment *Brined olives, whole, imported in casks*

1. Vacuum or Pressure on Container:

   Vacuum: – Inches Pressure: – Pounds

2. Product Odor: Typical *X* Off _____

3.

Headspace	Brine	No. Olives	Container Capacity	Solids/Brine Ratio
–	–	–	*Cask*	–

4. Chemical Analysis: Total Acid Stated As:

Turbidity	pH	% Lactic	% Acetic	% Red. Sugars	% Salt
1+ Visual	*3.30*	*0.30*	–	–	*9.00*

5. Olive Texture: Size *90/100* /kg Variety *Sevillano* Plunger Size *#4*

   Avg. *117* g Sum Total *4675* g Olive Range *75-225* g

6. Appearance: External *Medium green olive* Internal *Normal*

7. Product Flavor: *Flavor typical of commerce*

8. Judges' Scores: *Average of 5 judges = Closest to 1*

9. Remarks: *Only 1 + turbidity; brine may have been changed; olives soft; and the low pH with only 0.30% acidity indicates the natural olive buffering compounds have been washed out; apparently to control the softening action.*

10. Reason for Rating Given: *Soft olives*

11. Overall Commercial Acceptability: (Circle one numeral only)

Not Accept.	Barely Accept.	Poor	Fair	Good	Excellent
(1)	2	3 - 4	5 - 6	7 - 8	9 - 10

Exam. by *FFL Staff = 5 persons*

PART I—EXHIBIT D

Examination of Stuffed, Green Olives Imported in Casks

Place Exam. *Raleigh, NC* Date Exam. *1/18/71* Date Made _____

Product *Spanish-type, green, stuffed with pimento* Company *imported* Container Code No. *Lot #VI Cask 25*

Treatment *Brined olives, stuffed, imported in casks*

1. Vacuum or Pressure on Container:

   Vacuum: – Inches Pressure: – Pounds

2. Product Odor: Typical *X* Off _____

3.

Headspace	Brine	No. Olives	Container Capacity	Solids/Brine Ratio
–	–	–	*Cask*	–

4. Chemical Analysis: Total Acid Stated As:

Turbidity	pH	% Lactic	% Acetic	% Red. Sugars	% Salt
Visual OD x 10 *5+* *6.8*	*3.68*	*0.61*	–	*0.20*	*11.65*

5. Olive Texture: Size *280/300* /kg Variety *Manzanilla* Plunger Size *#4*

   Avg. *186* g Sum Total *7440* g Olive Range *90-250* g

6. Appearance: External *Light yellow* Internal *Stuffed; normal*

7. Product Flavor: *Very salty; good flavor; texture on low side, close to soft*

8. Judges' Scores: *5, 7, 4, 7, 6 = 29/5 = 5.9*

9. Remarks: *Too salty (almost 12%); sugar content above that acceptable for USA standards (this characteristic did not influence judges against the product, since they were not aware of it).*

10. Reason for Rating Given: *See above*

11. Overall Commercial Acceptability: (Circle one numeral only)

Not Accept.	Barely Accept.	Poor	Fair	Good	Excellent
1	2	3 - 4	5 - (6)	7 - 8	9 - 10

Exam. by *FFL staff = 5 persons*

PART I—EXHIBIT E

Examination of Stuffed, Green Olives Imported in Casks

Place Exam. *Raleigh, NC* Date Exam. *2/10/72* Date Made –

Product *Spanish-type, green, stuffed with pimento* Company *imported* Container Code No. *Lot #25, Cask 17*

Treatment *Brined green olives; stuffed, imported in casks*

1. Vacuum or Pressure on Container:

   Vacuum: – Inches Pressure: – Pounds

2. Product Odor: Typical *X* Off ____

3.

Headspace	Brine	No. Olives	Container Capacity	Solids/Brine Ratio
–	–	–	*Cask*	–

4. Chemical Analysis: Total Acid Stated As:

Turbidity	pH	% Lactic	% Acetic	% Red. Sugars	% Salt
OD x 10 7.0	*3.72*	*0.71*	–	*0.52*	*7.8*

5. Olive Texture: Size *240/260* /kg Variety *Manzanilla* Plunger Size *#4*
   (20 olives, 2 punctures each)
   Avg. *258* g Sum Total *10310* g Olive Range *200-300* g

6. Appearance: External *Light yellow* Internal *Stuffed; normal*
   No yeast spots

7. Product Flavor: *Good, salty, mild*

8. Judges' Scores: *9, 8, 9, 9, 8 = 43/5 = 8.6*

9. Remarks: *This is one of very few samples of olives from nearly 340 casks tested that have been rated "Excellent." Even so, the brine sugar content is too high (according to U.S. standards for import) and would preclude bottling until the sugar has fermented.*

10. Reason for Rating Given: *Good balance of flavor; good texture. It is quite possible that a residual 0.5% sugar in this product–at salt and acid content of about 7.50% and 0.70%, respectively, would enhance the product's overall acceptability for commercial use in the USA; it would have to be pasteurized.*

11. Overall Commercial Acceptability: (Circle one numeral only)

Not Accept.	Barely Accept.	Poor	Fair	Good	Excellent
1	2	3 - 4	5 - 6	7 - 8	(9) - 10

Exam. by *FFL staff = 5 persons*

PART I—EXHIBIT F

Imported, Whole, Green Olives Purchased in a Retail Store

Place Exam. *Chaska, Minn.* Date Exam. *7/29/66* Date Made _____

Product *Spanish-type, green, whole olives* Company *Packed for "F" foods* Container Code No. *H*

Treatment *Purchased in a supermarket retail store*

1. Vacuum or Pressure on Container:

   Vacuum: – Inches Pressure: – Pounds

2. Product Odor: Typical *X* Off _____ _____

3.

Headspace	Brine	No. Olives	Container Capacity	Solids/Brine Ratio
–	*4.50 oz.*	*20*	*7-oz. drained wt. (306 ml)*	–

4. Chemical Analysis: Total Acid Stated As:

Turbidity	pH	% Lactic	% Acetic	% Red. Sugars	% Salt
OD x 10 0.20	*3.80*	*0.55*	–	–	*6.70*

5. Olive Texture: Size *90/120* /kg Variety *Sevillano* Plunger Size *#4*
   (20 olives, 2 punctures each)
   Avg. *282* g Sum Total *11275* g Olive Range *110-370* g

6. Appearance: External *Pale, dull green to straw-variable* Internal *Dull, grayish, green*
   Yeast spots, no sediment, typical olive color

7. Product Flavor: *Salt, olive, acid, clean*

8. Judges' Scores: *Average score closest to 6*

9. Remarks: *ct 42-52/lb = Jumbo size; according to the pressure test readings of the 20 olives from the jar, two were rather soft (110-150 g and 160-160 g).*

10. Reason for Rating Given: *See above*

11. Overall Commercial Acceptability: (Circle one numeral only)

Not Accept.	Barely Accept.	Poor	Fair	Good	Excellent
1	2	3 - 4	5 - (6)	7 - 8	9 - 10

Exam. by *M. A. Gedney staff & JLE = 4 persons*

PART I—EXHIBIT G

Imported, Whole, Green Olives Purchased in a Retail Store

Place Exam. *Raleigh, NC* Date Exam. *1/20/71* Date Made *–*

Product *Spanish-type, green, whole olives* Company *"W-D" Company* Container Code No. *3, I*

Treatment *Purchased in supermarket retail store*

1. Vacuum or Pressure on Container:

   Vacuum: *10-1/2* Inches Pressure: _____ Pounds

2. Product Odor: Typical *X* Off _____

3.

Headspace	Brine	No. Olives	Container Capacity	Solids/Brine Ratio
–	*161 ml*	*19*	*11-oz; 330 ml* *7 oz drained wt.*	*51.3% solids*

4. Chemical Analysis: Total Acid Stated As:

Turbidity	pH	% Lactic	% Acetic	% Red. Sugars	% Salt
OD x 10 *0.15*	*3.25*	*0.68*	–	*0.00*	*6.93*

5. Olive Texture: Size *90/150* /kg Variety *Sevillano* Plunger Size *#4*
   (20 olives, 2 punctures each)
   Avg. *268* g Sum Total *10700* g Olive Range *200-325* g

6. Appearance: External *Medium to dark* Internal *Normal*

7. Product Flavor: *Flavor off; metallic*

8. Judges' Scores: *4, 4, 5, 5, 4 = 22/5 = 4.4*

9. Remarks: *Woody texture*

10. Reason for Rating Given: *Off flavor; poor texture (woody)*

11. Overall Commercial Acceptability: (Circle one numeral only)

Not Accept.	Barely Accept.	Poor	Fair	Good	Excellent
1	2	3 - (4)	5 - 6	7 - 8	9 - 10

Exam. by *FFL staff = 5 persons*

PART 1—EXHIBIT H

Imported, Stuffed, Green Olives Purchased in a Retail Store

Place Exam. *Raleigh, NC* Date Exam. *1/20/71* Date Made *–*

Product *Spanish-type, green, stuffed, Queens* Company *W-D Company* Container Code No. *None*

Treatment *Purchased in a supermarket retail store*

1. Vacuum or Pressure on Container:

   Vacuum: *11-1/2* Inches Pressure: _____ Pounds

2. Product Odor: Typical *X* Off _____ _____

3.

Headspace	Brine	No. Olives	Container Capacity	Solids/Brine Ratio
–	*135 ml*	*30*	*385 ml (13 oz.)*	*65% solids*

4. Chemical Analysis: Total Acid Stated As:

Turbidity	pH	% Lactic	% Acetic	% Red. Sugars	% Salt
Clear	*3.38*	*0.61*	–	*0.00*	*7.9*

5. Olive Texture: Size *90/120* /kg Variety *Sevillano* Plunger Size *#4*
   (20 olives, 2 punctures each)
   Avg. *224* g Sum Total *8975* g Olive Range *175-275* g

6. Appearance: External *Medium to dark olive* Internal *Normal*

   Yeast spots noted

7. Product Flavor: *Salty, but good flavor*

8. Judges' Scores: *5, 4, 6, 6, 5 = 26/5 = 5.2*

9. Remarks: _____

10. Reason for Rating Given: *See above, just fair*

11. Overall Commercial Acceptability: (Circle one numeral only)

Not Accept.	Barely Accept.	Poor	Fair	Good	Excellent
1	2	3 - 4	(5) - 6	7 - 8	9 - 10

Exam. by *FFL staff = 5 persons*

PART I—EXHIBIT I

Imported, Stuffed, Green Olives Purchased in a Retail Store

Place Exam. *Chaska, Minn.* Date Exam. *7/29/66* Date Made _____

Product *Spanish-type, green stuffed olives* Company *Packed for "F" foods* Container Code No. *U*

Treatment *Purchased in supermarket retail store*

1. Vacuum or Pressure on Container:

   Vacuum: – Inches Pressure: – Pounds

2. Product Odor: Typical *X* Off _____ _____

3.

Headspace	Brine	No. Olives	Container Capacity	Solids/Brine Ratio
–	*41 ml*	*34*	*2-oz. drained wt.*	–

4. Chemical Analysis: Total Acid Stated As:

Turbidity	pH	% Lactic	% Acetic	% Red. Sugars	% Salt
Clear	*3.80*	*0.36*	–	–	*6.6*

5. Olive Texture: Size *280/300* /kg Variety *Manzanilla* Plunger Size *#4*

   Avg. *160* g Sum Total *6400* g Olive Range *60-290* g

6. Appearance: External *Light to bleached* Internal *Normal*

   Clean, no yeast spots, no sediment

7. Product Flavor: *Pimento-olive, poor eating texture*

8. Judges' Scores: *4 judges; average score closest to 2*

9. Remarks: _____

10. Reason for Rating Given: *Poor texture, mainly; high variability of texture between olives*

11. Overall Commercial Acceptability: (Circle one numeral only)

Not Accept.	Barely Accept.	Poor	Fair	Good	Excellent
1	(2)	3 - 4	5 - 6	7 - 8	9 - 10

Exam. by *M. A. Gedney staff & JLE = 4 persons*

PART II—TABLE 2

Chemical and Physical Examination of a Single Shipment of Imported Green Olives

Sampling Date: *1/26/72* Date Received: *1/31/72* Analysis Date: *2/2/72* Lot No. *VIII*
Importing Company: *HEN* Shipper: *ARB* Variety: *Sevillano (nos. 1-23); Manzanilla = (nos. 24-29)*
No. of Samples: *29* Product or Treatment: *Imported, Spanish olives (whole or stuffed)*

Lab no. of sample	Cask no.	Count per kilo	Type of olive[1]	Examination of the olive brine						Olive quality	
				Brine level of cask	Turbidity	pH	Acidity as lactic acid	Reducing sugar[2]	NaCl	Olive firmness	OCA[3] score	Adjective rating[3]
					OD[4] x 10		%	%	%	g.		
1	179	90/100	Whole	—15 gal.	7.2	3.70	0.82	0.14	7.65	318	6.0	F
2	180	90/100	Whole	—35 gal.	7.4	3.75	0.84	0.14	7.55	310	7.6	G
3	182	100/110	Whole	Full	6.2	3.75	0.73	0.14	8.45	328	5.8	F
4	182	100/110	Whole	—	7.0	3.80	0.78	0.15	7.65	342	6.6	F
5	183	100/110	Whole	—	8.0	3.75	0.86	0.15	7.40	339	5.6	F
6	183	100/110	Whole	—	6.2	3.75	0.72	0.14	9.20	319	4.0	P
7	184	100/110	Whole	Full	6.2	3.80	0.76	0.14	7.70	368	4.0	P
8	185	100/110	Whole	—4 gal.	8.7	3.81	0.75	0.15	7.45	290	5.6	F
9	188	100/110	Whole	Full	6.2	3.85	0.78	0.13	7.85	341	5.6	F
10	188	100/110	Whole	—	6.6	3.80	0.75	0.15	7.90	333	6.2	F
11	190	100/110	Whole	—8 gal.	6.7	3.80	0.76	0.14	7.40	317	7.0	G
12	196	110/120	Whole	Full	6.5	3.75	0.72	0.15	7.90	340	6.4	F
13	198	110/120	Whole	—20 gal.	5.1	3.80	0.80	0.14	7.90	344	6.4	F
14	199	110/120	Whole	Full	7.2	3.75	0.82	0.14	7.40	337	6.8	G
15	200	110/120	Whole	Full	7.0	3.80	0.84	0.14	7.70	356	6.2	F
16	201	110/120	Whole	Full	7.4	3.85	0.85	0.15	7.20	332	6.0	F
17	202	110/120	Whole	Full	8.7	3.85	0.72	0.15	7.50	297	6.4	F
18	203	110/120	Whole	—	5.3	3.90	0.74	0.15	7.65	299	5.2	F
19	204	110/120	Whole	Full	5.1	3.85	0.73	0.13	8.15	330	5.8	F
20	205	110/120	Whole	—12 gal.	6.4	3.80	0.71	0.16	7.90	316	5.6	F
21	206	120/130	Whole	—10 gal.	8.0	3.90	0.79	0.14	7.20	322	6.8	G
22	208	120/130	Whole	Full	7.0	3.88	0.86	0.14	7.10	298	7.0	G
23	210	120/130	Whole	—13 gal.	7.2	3.85	0.80	0.13	7.40	309	7.0	G
24	10	240/260	Stuffed	—3 gal.	8.9	3.75	0.71	0.32	7.60	254	7.8	G
25	17	240/260	Stuffed	—4 gal.	7.0	3.72	0.71	0.52	7.85	258	8.6	E
26	62	280/300	Stuffed	—2 gal.	7.8	3.68	0.69	0.39	8.05	249	6.4	F
27	122	280/300	Stuffed	—5 gal.	6.9	3.75	0.65	0.39	8.00	270	6.0	F
28	134	300/320	Stuffed	—2 gal.	7.5	3.65	0.64	0.36	7.85	239	4.2	P
29	143	300/320	Stuffed	—2 gal.	8.7	3.70	0.76	0.21	7.80	255	6.2	F

[1]Olive odor was typical for the product examined; see Table III, footnote 1, for citations to references for the "Examination of Olive Brines."
[2]Values exceed U.S. Standards for imported green olives.
[3]Overall Commercial Acceptability: 1 =NA = Not Acceptable; 2 = BA = Barely Acceptable; 3-4 = P = Poor; 5-6 = F = Fair; 7-8 = G = Good; 9-10 = E = Excellent.
[4]Optical density of brine read at 650*n*.

PART III—TABLE 3

Summarized Results of the Examination of Nine Shipments of Imported, Spanish-Type Green Olives as to Certain Chemical and Physical Properties.[1,2]

Type of olive	Count per kilo	No. of casks sampled	Examination of olive brines: pH Range	pH Avg	Acidity as % lactic Range	Acidity as % lactic Avg	NaCl in % Range	NaCl in % Avg	Reducing sugars in % Range	Reducing sugars in % Avg	Olive firmness in g Range	Olive firmness in g Ave	Olive quality (OCA)[3] Numerical ratings Range	Numerical ratings Avg	Adjective ratings Range	Adjective ratings Avg
Lot no. I (3/17/66)[4,5]																
Pitted	240/260	4	4.35-4.75	4.54	0.18-0.56	0.44	5.26-7.47	6.00	0.05-0.08	0.07						
Whole	110/120	3	4.10-4.15	4.12	0.77-0.90	0.84	5.40-6.32	5.74	0.10-0.14	0.12						
Stuffed	80/90	1	—	4.00	—	0.70	—	6.62	—	0.17						
	90/120	5	3.85-4.00	3.95	0.64-0.70	0.70	7.01-8.53	7.56	0.13-0.19	0.16						
	120/130	2	3.80-3.95	3.88	0.72-0.89	0.80	7.65-7.77	7.71	0.11-0.21	0.61						
	280/300	6	4.20-4.35	4.27	0.47-0.57	0.53	6.85-8.38	7.63	0.08-0.10	0.09						
	340/360	5	4.10-4.15	4.13	0.43-0.56	0.50	7.61-8.62	8.19	0.06-0.08	0.07						
		26														
Lot no. II (4/24/67)																
Pitted	150/160	2	3.85-4.08	3.96	0.56-0.64	0.60	10.2-10.4	10.3	0.00-0.02	0.01						
	160/180	1	—	3.83	—	0.74	—	10.6	—	0.00						
	200/220	1	—	3.95	—	0.66	—	10.2	—	0.00						
	240/260	2	5.10-5.20	5.15	0.21-0.22	0.22	6.48-6.70	6.59	—	0.00						
	280/300	2	—	3.74	0.16-0.19	0.18	6.70-7.52	7.11	—	0.00						
Whole	80/90	1	—	3.74	—	0.73	—	10.8	—	0.00						
	90/110	7	3.82-3.99	3.91	0.13-0.65	0.56	9.66-10.8	10.2	—	0.00						
	130/140	1	—	3.79	—	0.71	—	9.75	—	0.00						
	140/160	5	3.76-3.92	3.84	0.61-0.80	0.67	9.15-10.3	9.77	0.00-0.02	0.00						
	160/200	2	3.97-4.02	4.00	0.44-0.54	0.49	—	10.4	—	0.00						
	200/220	1	—	4.22	—	0.40	—	10.4	—	0.00						
	280/300	1	—	3.98	—	0.51	—	9.90	—	0.00						
Stuffed	80/90	2	3.76-3.83	3.80	0.42-0.66	0.54	11.1-11.2	11.2	0.00-0.02	0.01						
	90/120	5	3.66-3.78	3.75	0.61-0.76	0.72	10.0-10.6	10.3	0.00-0.03	0.01						
	120/130	2	3.77-3.81	3.79	0.68-0.72	0.70	10.2-10.6	10.4	0.00-0.02	0.01						
	140/160	2	3.80-3.84	3.82	0.63-0.64	0.64	10.2-10.6	10.4	—	0.00						
	240/260	5	3.78-5.50	4.77	0.07-0.32	0.23	7.50-10.9	9.66	—	0.00						
	280/300	9	3.82-4.92	4.18	0.24-0.64	0.44	6.90-11.1	9.61	—	0.00						
	300/360	6	3.78-5.83	4.34	0.20-0.68	0.37	6.88-10.9	9.12	—	0.00						
		57														
Lot no. III (10/13/67)																
Whole	160/200	5	3.92-4.30	4.21	0.26-0.37	0.32	9.45-11.0	10.1	—	0.00	174-229	196	3-6	5	P-F	F
	200/240	1	—	3.90	—	0.30	—	10.0	—	0.00	—	193	—	3	—	P
	240/260	27	4.00-4.25	4.10	0.28-0.46	0.37	8.05-10.0	9.36	—	0.00	207-275	237	4.7	5	P-G	F
	280/300	4	4.02-4.18	4.12	0.32-0.38	0.34	9.21-9.50	9.31	—	0.00	203-234	223	—	5	—	F
Stuffed	240/260	1	—	3.85	—	0.31	—	9.69	—	0.00	—	179	—	4	—	P
	300/340	1	—	4.05	—	0.27	—	9.61	—	0.00	—	177	—	4	—	P
		39														
Lot no. IV (12/6/68)																
Whole	140/160	19	3.56-4.01	3.64	0.56-1.00	0.75	7.78-9.58	8.70	0.01-0.04	0.03	293-343	318	4.4-6.8	5.9	P-G	F
	180/200	2	3.63-3.81	3.72	0.62-0.75	0.68	8.44-8.46	8.45	0.02-0.03	0.02	277-326	296	6.4-6.8	6.6	F-G	G
	200/220	11	3.58-3.84	3.68	0.50-0.86	0.77	8.82-9.66	9.19	0.02-0.03	0.03	284-330	307	4.0-7.4	6.0	P-G	F
	240/260	10	3.68-3.93	3.79	0.51-0.83	0.65	8.24-9.58	8.90	0.01-0.03	0.02	273-319	299	4.4-7.8	6.7	P-G	G
		42														

See footnotes at end of table.

PART III—TABLE 3 (cont.)

Summarized Results of the Examination of Nine Shipments of Imported, Spanish-Type Green Olives as to Certain Chemical and Physical Properties.[1,2]

Type of olive	Count per kilo	No. of casks sampled	Examination of olive brines: pH Range	pH Avg	Acidity as % lactic Range	Acidity as % lactic Avg	NaCl in % Range	NaCl in % Avg	Reducing sugars in % Range	Reducing sugars in % Avg	Olive firmness in g Range	Olive firmness in g Ave	Olive quality (OCA)[3]: Numerical ratings Range	Numerical ratings Avg	Adjective ratings Range	Adjective ratings Avg
Lot no. V (6/1/70)																
Whole	90/120	18	3.30-3.80	3.64	0.15-0.41	0.32	8.50-10.6	9.51			117-264	221	1.0-7.5	5.7	NA-G	F
Stuffed	240/260	1	—	3.70	—	0.40	—	10.8	(Not Run)		(Not Run)		—	6.0	—	F
	280/300	3	4.00-4.10	4.03	0.28-0.40	0.36	7.30-7.90	7.63					5.0-6.0	5.0	—	F
	300/360	2	3.80-4.10	3.95	0.37-0.53	0.45	7.40-7.75	7.58					3.0-4.0	4.0	—	P
		24														
Lot no. VI (1/8/71)																
Whole	90/120	12	3.62-4.38	4.13	0.30-1.14	0.53	6.37-9.30	8.50	0.00-0.23	0.05	286-345	311	5.0-8.0	6.4	F-G	F
Stuffed	240/260	13	3.65-3.98	3.76	0.37-0.62	0.54	11.1-12.6	12.1	0.00-0.31	0.12	154-221	171	2.6-5.0	4.1	P-F	P
	280/300	11	3.55-3.70	3.63	0.58-0.69	0.62	11.3-12.3	11.9	0.09-0.27	0.17	170-219	192	4.2-5.9	5.3	P-F	F
		36														
Lot no. VII (3/23/71)																
Whole	90/120	31	3.70-3.90	3.74	0.68-1.04	0.92	6.15-7.05	6.64	0.12-0.24	0.15	238-310	280	5.0-8.0	7.1	F-G	G
		31														
Lot no. VIII (1/31/72)																
Whole	90/120	20	3.70-3.90	3.80	0.71-0.86	0.77	7.20-9.20	7.78	0.13-0.16	0.14	290-368	328	4.0-7.6	5.9	P-G	F
	120/130	3	3.85-3.90	3.88	0.79-0.86	0.82	7.10-7.40	7.23	0.13-0.14	0.14	298-322	310	6.8-7.0	6.9	—	G
Stuffed	240/260	2	3.72-3.75	3.74	—	0.71	7.60-7.85	7.72	0.32-0.52	0.42	254-258	256	7.8-8.6	8.2	G-E	G
	280/300	2	3.68-3.75	3.72	0.65-0.69	0.67	8.00-8.05	8.02	—	0.39	249-270	260	6.0-6.4	6.2	—	F
	300/320	2	3.65-3.70	3.68	0.64-0.76	0.70	7.80-7.85	7.82	0.21-0.36	0.28	239-255	247	4.2-6.2	5.2	P-F	F
		29														
Lot no. IX (8/27/73)																
Whole	90/120	11	3.90-4.30	4.12	0.28-0.48	0.38	8.35-9.90	9.22	0.00-0.22	0.16	206-286	259	5.2-7.0	6.8	F-G	G
	120/130	1	—	3.95	—	0.44	—	8.25	—	0.20	—	276	—	6.6	—	G
Stuffed	280/300	32	3.80-4.07	3.95	0.33-0.88	0.57	8.50-10.2	9.21	0.00-0.20	0.13	202-305	254	4.0-8.0	6.9	P-G	G
	300/360	11	3.85-4.10	3.97	0.36-0.66	0.53	9.10-10.6	9.75	0.00-0.23	0.15	222-286	253	2.2-6.8	5.5	BA-G	F
		55														
Grand Total		339														

[1]Routine chemical and physical tests on the brine samples included those for acidity, pH, optical density, salt concentration, and visual turbidity used in the "EVALUATION" section. The procedures used were those described by J. L. Etchells, R. N. Costilow, T. E. Anderson, and T. A. Bell, Applied Microbiology *12* (1964) 523-535; measurement of reducing sugars in the brines was by the method of J. B. Sumner and G. F. Somers, "Laboratory Experiments in Biological Chemistry," Academic Press, Inc., New York (1944).

[2]Olive firmness values not available for Lot nos. I and II; lack of this data precluded developing olive quality ratings for these lots as we prefer to prepare them.

[3]Overall Commercial Acceptability: 1 = NA = Not Acceptable; 2 = BA = Barely Acceptable; 3-4 = P = Poor; 5-6 = F = Fair; 7-8 = G = Good; 9-10 = E = Excellent.

[4]Date samples were received at the laboratory.

[5]Our olive pressure tester, although used for experimental studies (Etchells *et al., Appl. Microbiol.* 14 (6): 1027-1041, 1966), was not used on a large-scale basis for olive shipments until early 1967.

PART IV

NOTES ON RECEIVING IMPORTED OLIVES FOR SOUTHEASTERN USA[1]

General Procedure:

(a) Olives arrive by ship at the dock at Norfolk, Virginia, USA.

(b) The import broker calls and says the shipment has arrived or is being unloaded and advises when cleared by customs and the Food and Drug Administration.

(c) The importer, within a reasonable distance, sends a crew from their plant to the pier with dry salt and rebrining equipment, including empty casks, hose and tools.

(d) All casks are first checked for leakers. Leaking containers are then inspected for condition of the olives and then rebrined; patched or repaired.

(e) The bad leakers are taken at once to the packing plant, provided the brined olives are still in good condition. Generally, none are left at the pier, even if the olives are bad. Report on condition is filed at pier.

(f) For the more severely damaged casks, the insurance agent is called for adjustment; but always, they ask that the casks be sent to the plant for rebrining and salvage. The adjustor surveys and determines the extent of damage.

(g) The importers we talked to said that there seems to be a definite lack of uniformity as to salt and acid content of olive brines in the same shipment, even though all casks arrive in perfect condition.

(h) The acid and salt content of imported olives varies from exporter to exporter; some are better than others.

(i) Olives arriving in metal drums are, in general, received in better condition than those in wooden casks, even though they (drums) may be hotter for storage. Olives in unitized containers arrived in excellent condition!

(j) The New York City piers have their own coopers who will repair leaking casks before rebrining. There are coopers at Norfolk piers also, but they are not as experienced or as adept at making repairs as the New York coopers.

Further Remarks:

(a) Olives that are imported (Spain) can be on the boat ten days to two weeks and then another week on the train trip from Norfolk.

(b) One importer interviewed has received barrels of butyric acid olives with *no evidence of leakage* upon arrival at the Norfolk dock!

(c) An importer orders so many "Fanegas" (1 fanega = 16 U.S. gallons) of olives from the broker but does not stipulate the size or type of container. Historically, plain "Queens" are shipped in 10-fanega casks. Some importers receive a small quantity in metal drums for reshipment to their bulk customers. Pitted olives are always in 3-fanega barrels or metal drums. Stuffed olives come in barrels or 6-fanega casks (half casks).

(d) Only stuffed or pitted olives are shipped in metal drums to one of the importers we interviewed.

(e) The broker arranges for the olives but does not in any way test the olives being shipped.

(f) According to the importers, black, plastic containers are considered too hot for outside storage of olives in southern USA. Texture loss for onions has also been noted for such containers stored in the sun; some texture loss also has been noted for olives contained in metal drums.

[1]Based on discussions with major southeastern USA repackers of imported, fermented, green olives, primarily from Spain.