Citrus fruits - Containers O.S.

Citrus Fruit Packaging

by

Prof. Roy J. Smith

INDEX

The Citrus Marketing Board of Israel,
TEL-AVIV,
Israel.

14th April, 1955

PREFACE

The following memoranda cover findings and observations made of the Israeli Citrus marketing situation during the winter and early Spring of 1955 by myself. The occasion for the survey was a sabbatical granted me by the Regents of the University of California. The Citrus Marketing Board of Israel invited me to make the survey and covered the expense involved.

I wish to express my appreciation both to the Regents and to the Board for making the trip possible. It was a most fortunate opportunity to enlarge my field of study. I hope the Citrus Industry people of Israel and perhaps also of California will find, eventually, something of value in the survey.

The subject matter of the survey, while objectively made as broad as possible, came necessarily to revolve largely around the prospects for adoption of the corrugated half-box carton with a naked pack in place of the current wooden crate with a wrapped pack. The successes in such changes realized in recent years in California was the reason for making this survey. If the change can be made, the economic advantages are very great.

A word of apology must be entered for my not having a detailed statement on the economic evaluation involved. The difficulties imposed by language, different accounting techniques and exchange complexities, prevented my putting together the data necessary for such a statement. The contrast in costs between the two packaging systems, however, are so great as to make a detailed economic analysis of secondary importance. The problem is one of Fruit quality. If this can be improved, as has been done in California, there can be no question that Israel could gain much by using the new package. To achieve such success, however, will require some careful research work.

Whatever success may accrue from the investigation must be accredited largely to a great many individuals with whom I came in contact. It is impossible to name them all but a few must be mentioned specifically. If my suggestions are eventually found to have merit, they must be regarded (in the main) to be sound because of the information made available to me by Dr. F.S. Littauer and his Staff. His wholehearted help was the basis of whatever success may be attained.

Dr. I.D. Ophen of the Department of Agriculture and Dr. A.S. Arnon of the Citrus Marketing Board were both exceedingly helpful and most generous. Mr. F. Pintow gave his time unremittingly to the investigation.

In my survey of the English and European markets whilst going to, and returning from Israel, Mr. M. Levin and his Staff particularly Mr. A. Markov, were most helpful. Mr. J.F. Lane of Marks & Spencer was most helpful and in particular arranged for the printing of this report.

Mr. Egra Danen, Mr. J. Jacobson, Mr. M.H. Sachs, Mr. Chorin, Dr. Nadle, Mr. Gadel, Dr. Y. Carmon, Mr. M.S. Giluty, Mr. F. Gradienski, Mr. Wassermann, Mr. J. Gasundhich, Mr. F. Brandstetter, Mr. Atlas and many others were most generous in their help.

Israel has a great wealth in People with ability and generosity. I wish them *La Cheim*.

SHALOM SHALOM

ROY J. SMITH
Department of Agricultural Economics
UNIVERSITY OF CALIFORNIA

1 - PROCEDURES IN DIMENSIONS OF CARTONS AND WORKING OUT OF PACK PATTERNS

As shipments have been made in recent months, an increasing demand has been apparent for a carton dimensioned so that an exact proportion of the fruit of a wooden case would be shipped. The first step, of course, was to determine the amount of fruit that was being shipped in the wooden cases.

Amount of Fruit in Wooden Cases -

Grapefruit
74 case

Length 34.6 cm. Ends and Middle ext. to equal 4.8 cm.
Width 35.0 cm. Ends
2.5 cm. Grapefruit squeeze
37.5 cm. Total

Height 30.0 wood
3.0 bulge
33.0

Floor area 1,297.5 sq.cm.
Volume 42,817.5 cu.cm.

Oranges (Shamouti)
74 case

Width 35.0 cm. End
1.0 Shamouti oranges
36.0 Total

Floor Area 1,245.6 sq.cm.
Volume 41,104.8 cu.cm.

70 case

Length 32.6 cm.
Width 28.0 Ends
1.0 Shamouti squeeze
29.0 Total

Height 30.0 Wood
3.0 Bulge
33.0 Total

Floor Area 945.4 sq.cm.
Volume 31,198.2 cu.cm.

These case measurements are of one compartment with an estimate of the average "good pack" height for each case and each variety of fruit and an estimate of the average "good pack" squeeze sideways for each case and each variety. By "good pack" we mean a pack which Managements and Inspectors indicated to be a desirable pack of fruit and which they were able to achieve often enough to justify regarding it as an average "good pack". In presenting our findings, I should like to emphasise that we did not have time to make an adequate survey, so as to be sure that these figures represent actual average industry practice. Another investigator would well find some different figures to be better. The difference, however, would be small.

The squeeze sideways (sideways to fruit) estimate, is a necessary step in measuring because actual fruit dimensions are involved, but the squeeze cannot be duplicated in the carton. The carton must be that much larger. Somewhat the same consideration holds for height, but our measurement was made before lidding so the estimate was easier to make. While the "top dressing" in volume fill and the automatic closing and sealing of cartons permits a slight squeeze, it is inconsequential in comparison.

Variety Difference

Our conclusion was that the side squeeze on Shamouti Oranges approximated 1 cm. in amount - on Grapefruit 2.5 cm. Our findings as to height, while somewhat different in measurement averages, was that the difference was not great enough or our measurements in large enough number, to justify differentiation. Our conclusion was that a height of 33 cm. from the bottom of the case was an adequately representative figure.

CARTON STANDARDIZATION

The difference in the side squeeze, however, forced us to make a decision. Should we design a somewhat larger carton for Grapefruit than for Shamouti Oranges? Some of the considerations involved are as follows -

1. Packing houses, particularly at the Rehovot Pardess Co-operative house, mix their handling of Oranges and Grapefruit. In the Rehovot plant, the two varieties are run at the same time. Since it is almost impossible and utterly impractical to run cartons with different dimensions through the same volume-fill and sealing equipment, either separate machines or houses would have to be set up for the separate varieties or a common dimension used.

2. Stacking of cartons on pallets, trucks, in railway wagons and on shipboard would be complicated. A different pallet would be required for each dimension. The two dimensions would have to be kept separate on shipboard otherwise stacking strength would be materially reduced.

3. The carton manufacturers' costs would be increased.

4. The market acceptability would be reduced, both buyer and seller having to keep in mind the different quantities involved.

Since the change or difference between the two varieties was small, our decision was to dimension for the Shamouti Oranges and to assume that the size of the Grapefruit would be reduced to the very small amount required. If the Industry should decide not to reduce its Grapefruit sizes accordingly, it could easily enlarge the carton dimensions suggested or get more Grapefruit in the Shamouti carton by bulging the sides. I would not recommend such a practice, however.

NEW CARTON DIMENSIONS

Our investigation resulted in three new carton dimensions. One, a half duplicate of the "74" case and two half duplicates of the "70" case. All dimensions require further detailed testing and minor adjustments, particularly the "70" carton, dimensioned at 430 x 280 x 250. This, it will be recognised, is virtually the same as the box now used in Israel, as well as in California, where it originated.

The *large* carton (455 x 300 x 300) gave us a nearly perfect packout of count sizes from the "74" case. Attached is a description of these packout findings. Only two variations occurred, a 144 in place of 147 for Oranges and 64 in place of 63 for Grapefruit. Some further work needs to be done on these patterns, but it would appear practical to conclude that the carton dimensions found are near perfect if a carton this large is deemed desirable.

The reason for there being two half duplicates of the "70" case was that we found the carton we designed having the same floor space as the "70" case compartment did not give a like shape to the California carton. This first, or tall "70" carton (390 x 255 x 300), gave us a perfect count packout from the "70" case for Oranges and promises a fairly good packout from the "74" case for Grapefruit.

This tall carton, however, differed sufficiently in shape to lead one to conclude that further testing should be carried out. Modifications were attempted on the California carton which, as used in Israel, has been measuring 415 x 290 x 250. Little improvement could be made, but we suggest trying 430 x 280 x 250. As shown on the attached table, it is established that a half count can be very closely approximated. *However, much more work should be done.*

In both the smaller cartons, further work needs to be undertaken on patterns from the "74" case. It may be noticed that the work so far concluded points strongly to the fact that the "74" case is exactly ⅓ larger than the "70" case. That is, a 96 size Grapefruit in the "74" case will packout to 36 in the two small cartons. 36 is three quarters of 48, half of 96. Also 48 is one third larger than 36. Possibly, some adjustment could be made in the two small cartons in order to achieve this count relationship. Such a simple relationship would be most valuable in marketing practices.

Length and Width of Carton

These three cartons have been dimensioned so that the outside length is 50% greater than the outside width. Commonly this proportion is called the 3 to 2 relationship. The purpose is to allow the stacking of 2 lengthwise on 3 crosswise or the reverse. It is regarded by the paper carton industry as a good principle to follow.

SPECIAL PROCEDURES

In working out these new dimensions the following suggestions may also be drawn to your attention -

1. Use only properly sized Fruit. In Israel, as in California, the only criteria of size that means anything is that size which is found in a case of a particular pattern, resulting in the desired squeeze and crown. A good pack, once put together, gives a good size. Some necessary variation occurs between Fruits though, of course, certain excessive variation should be avoided.

   I may note that in my experience if a person tries to look at a Fruit and measure it with his hands and then decides *conclusively* whether or not it is of this size or that size, he only proves that he does not know how to size the Fruit. Such practices should be avoided. One could discuss this point at considerable length, having in mind regulatory practices and laws, as well as packing house and market practices.

   The point may be concluded, however, with the recommendation that the only way to size Fruit for our problem of carton dimensioning is to first pack it out in the standard wooden case. That is the practice followed above.

   For certain size counts a packout into the new container from the old may not be possible. Keep such cases as few as possible.

   Where the two case sizes do not conform to the same Fruit sizes, an arbitary decision is necessary in the choice between the cases but it would seem wise to follow the suggestions outlined below under the heading of "The Ideal Size Count Relationships".

2. In trying to transfer a given set of size counts to a new container, the problem is simplified if the floor space is near the same in the new as in the old. The same pattern may often be used. Adjustment should be allowed for the squeeze of Fruit in the wood, which cannot be duplicated in the carton. The length and width of the two containers may vary considerably and still allow use of the old patterns.

3. The height can be approximated very well by relating the total volume of Fruit from the old container to the floor space of the new container.

4. After this initial dimensioning further steps are necessary if a really good job is to be done.

   (a) Make such adjustments as appear necessary in the dimension of the container, having in mind all size counts and if the same standard dimension is wanted for more than one variety, having in mind all size counts of all varieties.

   (b) Make adjustments in the size relationships in each variety. These should be small adjustments but are quite likely necessary.

   (c) Make adjustments in counts in -

      (i) variety. It follows that some re-sizing will be necessary.

ORIENTATION OF GRAPEFRUIT ON SIDE

It will be noted that some of the purposed Grapefruit packouts place them all or certain rows on the side. No reason has been suggested as to why the Fruit should be damaged by such a practice. On the contrary, by allowing a more perfect fit to the Fruit in the carton, excessive tightness or looseness may be avoided, and thus damage prevented.

The important advantage in allowing some sidepack is that it greatly increases the number of pattern arrangements possible and thus improves the count size relationships.

THE PATTERNS

Attached are the various patterns that have been developed. Considerably more work needs to be done, particularly in packing into the new California carton. The new California carton, incidentally, is almost identical to the old.

PACKOUT OF FRUIT FROM "74" CASE INTO LARGE CARTON 455 x 300 x 300

(Preliminary)

ORANGES				*GRAPEFRUIT*			
Standard Case Sizes	*CARTON counts*	*Pattern*	*Layers*	*Standard Case Sizes*	*CARTON counts*	*Pattern*	*Layers*
120	60	3 x 3	15 in layers 4 layers	80	40	3 x 2	10 in layers 4 layers all flat.
150	75	3 x 3	15 in layers 5 layers	96	48	3 x 3	12 in layers 4 layers all flat.
180	90	3 x 3	18 in layers 5 layers	112	56	4 x 3	14 in layers 4 layers 1 row on side layer, successive rows.
210	105	3 x 3	21 in layers	126	**64** (new count)	4 x 4	16 in layers 4 layers all flat.
240	120	4 x 4	24 in layers 5 layers	150	75	3 x 3	15 in layers 5 layers all flat.
294	**144** (new count)	4 x 4	24 in layers	176	88	4 x 3	18 - 17 in layers 5 layers all flat.
336	168	4 x 4	28 in layers 6 layers.				

Large End Size

A peculiarity in the sizing of Fruit in the two cases is that there would appear to be a better sequence of the very large sizes in the "74" case than in the other. The 180, 150 and 120 sizes represent an exact 30 count spacing. The 150, 126 and 100 counts represent a little larger spacing in the larger size which, of course, is undesirable. More important, the 100 in the "70" case includes almost all of the Fruit in the 150 and 120 sizes of the "74"; consequently these large "end" sizes are not only separated out further in the end size of the "70" case, but include two sizes which I carefully split into two sizes in the "74". A packing house operator would find sizing far easier in the "74" case sequence. In fact, the end size of the "70" case could not be packed with all of the Fruit available. I was told in Israel that in fact, some of the largest Fruit was often not packed for this reason.

This specific problem, of course, could easily be solved by proper size classification. It will be noted that size sequences similar to the "74" are made available for all three cartons that are recommended for examination.

PACKOUT OF FRUIT INTO NEW HIGH CARTON - HALF "70"
CASE SIZE: 390 x 255 x 300 (PRELIMINARY)

1. ORANGES

ORANGES FROM "70" CASE				*ORANGES FROM "74" CASE*			
Standard Case Sizes	*CARTON*			*Standard Case Sizes*	*CARTON*		
	Counts	*Pattern*	*Layers*		*Counts*	*Pattern*	*Layers*
100 ½ = 50	50	3 x 2	10 in layers 5 layers	120 ⅜ = 45	48	3 x 3or 4 x 4	12 in layers 4 layers
126 ½ = 63	63	3 x 2	13-12 in layers 5 layers	150 ⅜ = 56¼	56	4 x 3	14 in layers 4 layers
150 ½ = 75	75	3 x 3	15 in layers 5 layers	180 ⅜ = 67½	63	3 x 2	13-12 in layers 5 layers
176 ½ = 88	88 90	4 x 3 3 x 3	18-17 in layers 5 layers 18 in layers 5 layers	210 ⅜ = 78¾	75	3 x 3	15 in layers 5 layers
216 ½ = 108	105 108	4 x 3 3 x 3	18-17 in layers 6 layers 18 in layers 6 layers	240 ⅜ = 90	88 90	4 x 3 3 x 3	18-17 in layers 5 layers 18 in layers 5 layers
252 ½ = 126	126	4 x 3	21 in layers 6 layers	294 ⅜ = 110¼	105 108	4 x 3 3 x 3	18-17 in layers 6 layers 18 layers 6 layers
288 ½ = 144	144	4 x 4	24 in layers 6 layers	336 ⅜ = 126	126	4 x 3	21 in layers 6 layers

2. GRAPEFRUIT (FROM "74" CASE)

Standard Case Sizes	*CARTONS*		
	Counts	*Patterns*	*Layers*
80 ⅜ = 30	30	3 x 2	8-7 in layers. 4 layers all flat.
96 ⅜ = 36	36	3 x 3	9 in layers. 4 layers all flat.
112 ⅜ = 42	42	4 x 3	11-10 in layers. 4 layers. 1 row on edge, successive rows 1st three layers.
126 ⅜ = 47¼	48	4 x 4 or 3 x 3	12 in layers. 4 layers, orientation unknown.
150 ⅜ = 56¼	56	4 x 3	14 in layers. 4 layers, orientation unknown but probably on edge.
176 ⅜ = 66	63 70	3 x 2 4 x 3	13-12 in layers. 5 layers all flat. 14 in layers. 5 layers all flat.

PACKOUT OF FRUIT INTO NEW CALIFORNIA CARTON, HALF "70"
CASE SIZE 430 x 280 x 250 (PRELIMINARY)

1. ORANGES

ORANGES FROM "70" CASE				*ORANGES FROM "74" CASE*			
Standard Case Sizes	*CARTON*			*Standard Case Sizes*	*CARTON*		
	Counts	*Pattern*	*Layers*		*Counts*	*Pattern*	*Layers*
100 ½ = 50	50	3 x 2	13-12 in layers 4 layers	120 ⅜ = 45	48	3 x 3	12 in layers 4 layers
126 ½ = 63	64	4 x 4	16 in layers 4 layers	150 ⅜ = 56¼	56	4 x 3	14 in layers 4 layers
150 ½ = 75	75	3 x 3 or 3 x 2 from end	15 in layers 5 layers may be loose	180 ⅜ = 67½	64	4 x 4	16 in layers 4 layers
	80	4 x 4	20 in layers 4 layers				
176 ½ = 88	90	3 x 3	18 in layers 5 layers	210 ⅜ = 78¾	75	3 x 3 from side or 3 x 2 from end	15 in layers 5 layers - may be loose
	80	4 x 3	18-17 in layers		80	4 x 4	20 in layers 4 layers
216 ½ = 108	105	4 x 3	21 in layers 5 layers	240 ⅜ = 90	90	3 x 3	18 in layers 5 layers
	113	5 x 4 or 3 x 2	23-22 in layers 5 layers		88	4 x 3	18-17 in layers
252 ½ = 126	125	5 x 5	25 in layers 5 layers	294 ⅜ = 110¼	105	4 x 3	21 in layers 5 layers
					113	5 x 4 or 3 x 2	23-22 in layers 5 layers
288 ½ = 144	140	4 x 3	28 in layers 5 layers	336 ⅜ = 126	125	5 x 5	25 in layers 5 layers
	150	6 x 5	30 in layers 5 layers				

2. GRAPEFRUIT (FROM "74" CASE)

Standard Case Sizes	*CARTONS*		
	Counts	*Patterns*	*Layers*
80 ⅜ = 30	30	3 x 2 3 x 2	10 in layers. 3 layers. 8-7 in layers. 4 layers, orientation unknown.
96 ⅜ = 36	36	3 x 3	12 in layers. 3 layers, all on side.
112 ⅜ = 42	42	4 x 3	14 in layers. 3 layers, orientation unknown.
126 ⅜ = 47¼	48	4 x 4	16 in layers. 3 layers, orientation unknown.
150 ⅜ = 56	56	4 x 3	14 in layers. 4 layers, all flat.
176 ⅜ = 66	66	3 x 4 4 x 3	17-18 in layers. 3 layers on edge plus 14 in layers. 1 layer flat.

THE IDEAL SIZE-COUNT RELATIONSHIP

In any dimensioning of a new container there are always two objectives to keep in mind. **First** - a new size count relationship as near identical as possible to that now accepted as suitable in the market. **Second** - a size count relationship which progresses by logically even steps and which, if reasonably proportional from size to size, makes setting a mechanical sizer and building a uniform pack far easier than it would be otherwise.

To illustrate this second point I may suggest that a 216 is far closer to a 200 than to a 252. To pull out from a run Fruit which will pack a good 216 means pulling out the small 200's and making that pack high. On the other hand, the good 216 pack leaves many large Fruit for the 252, also making that pack high. The 216 is very difficult to keep to the same high level. For that reason, California long ago went to a 220 in place of a 216 and I recommend for volume-fill a packout aiming at about 224 in place of either 216 or 220. The 224 is practical in volume-fill for no 224 pattern is required.

It may be noted that this ideal progression is not by equal count steps. Rather each step becomes larger as the Fruit gets smaller.

To my mind, in introducing a new container, a definite advantage exists for maintaining a size count relationship to which the market is accustomed. On the other hand, if this customary size count cannot be worked out in successive patterns some attention may well be paid then to the second objective.

The progression of steps for oranges in the "74" case, it may be noted, is in part quite illogical. The first four steps are precisely 30 each, then the step is 54, almost double, then back to 42. Dropping the 294 to a smaller size not only seems logical, but would make the sizing easier.

Another potential example is found in the packover of Oranges from the "74" case into the new **high** carton. The 240 (90) pack is good and the 336 (126 count) pack is good, but no exact pattern can be worked out for the 294 (110¼ count) pack. Now the step from 90 to 110¼ is 20¼ and from 110¼ to 126 is 15¾. The second step is much smaller though it deals with smaller fruit. If, instead of 110¼ we examine a count of 105, the step from the larger size is 15 and to the smaller 21, more logical though possibly a little more of a change than one could wish. Moreover, 105 allows a pattern of 4 x 3 which, in 6 layers, gives quite a good pack. Since a count of 110¼ exactly is impossible, it does not seem inadvisable to shift to the 105; both the step relationship and the pattern obtainable support the shift.

SOME SPECIFIC COMMENTS ON PROPOSED PACKOUTS ON NEW CARTONS

It is understood by all, I am sure, that the pattern packouts shown in the attached tables should be subjected to very thorough examination. Certain relationships have been sought, however, and it may be desirable to point them out.

The count size patterns for the **large** carton for one-half the "74" case appear to be very good. In Shamoutis and in Grapefruit each there is one small change. In both cases the change not only made it possible to develop a pattern, but the count step relationships with adjacent sizes were improved.

The two smaller cartons, however, presented a very different type of problem. While it was assumed that all Grapefruit was packed from a "74" case and the necessary size count relationship was the relatively simple 3/8's, in Oranges it was necessary to dimension and pattern each of the two small cartons so that a single new size count and pattern system would have the minimum variation from both the "74" Shamouti packout and the "70" Shamouti packout. It was also desirable to have the same system applicable to Valencias and possibly to Lemons.

It will be noticed then that for each small carton there is provided an identical packout from the "70" case and the "74" case. This condition we can regard as a practical necessity. A packing house would be foolish to attempt a different size count for different markets. But, since the two cases did not use the same Fruit sizes, the new systems cannot duplicate both cases perfectly. Thus, each of the smaller cartons have a handicap in their compromise between the two cases. Obviously some judgement will need to be exercised in choosing the best patterns. Some patterns shown will be too tight, others too loose. For these reasons, more than one suggestion has been presented for a number of packs.

New California Carton

This carton, so far as can be judged without further pack testing, has a near perfect packout for Grapefruit. Any variation in count is a fraction of one and the step sequences are 6, 6, 6, 8 and 10. Being free to turn any row of Fruit on its side greatly increases the packout possibilities.

For Oranges from the "74" case, a near perfect packout is provided for 150s, 240s and 126s. The Fruit is maintained at the same general size level as in the old pack except that in the 180s, 210s and 294s somewhat larger Fruit with corresponding fewer numbers, are suggested. The successive steps of 8, 8, 11, 15, 15 and 20 are very good. However, some alternative pattern may be better.

For Oranges from the "70" case, a near perfect packout is found for all but the smallest size of 288. The first step of 14 is larger than the second of 11 and it seems probable that the Industry will want to use the packout derived from the "74" case of 48, 36 and 64, provided these patterns are found to pack well enough. The question of whether to use a 140 or a 150 for the last and smallest Fruit size is an interesting one. The step to 150 is more logical, but such a size may occur so seldom that it may not be as useful as a 140. A 144 with 24 in first layer might be packed by a good packer. It would be logical with volume-fill.

New High Carton

The Grapefruit packout has been sufficiently tested in the larger sizes to justify confidence that it can be worked out satisfactorily. Only in the smallest size of 176s would there appear to be real difficulty. The other steps of 6, 6, 6 and 8 are good.

The Orange packover from the "70" case is perfect except for 216s. Even there the 108 may be better than the 105. The 105, however, makes a greatly improved step interval possible, there being steps of 17 and 21 with the next smaller and larger sizes respectively, rather than 20 and 18, which reverses the sequence from what is desired. The sizing would be easier.

For the "74" case packover, a perfect 150 and 336 were found. The 90 rather than the 88 may be best for the 240 too, as the count is perfect there but the 88 is perfect for the 176 in the "70" case and you would not want to use both. The other changes shown appear necessary if a desirable packout is to be achieved.

It should be noted that in general this new high carton packs very well. Working out a pattern is easy and the Fruit seems to fit into the dimensions very well.

2 - DESIRABLE SIZE OF CARTON

One problem connected with the carton development is its size. The final decision is a purely commercial matter and the assumption in this memorandum is that the decision will be based purely on the price the market will pay per pound of Fruit when packaged, having in mind the long term view and the relative costs.

HISTORY OF SIZE OF WOODEN CASE

A considerable controversy has existed about the respective merits of the "70" and the "74" cases. My understanding is that originally some 25 years ago, cases similar to the "70" were used. With the depression of the 1930's, returns here, as elsewhere, became very low and resort was made to offering buyers more Fruit per case. Shippers, handlers and workers were all so anxious for shipments to continue that they agreed to handle the larger case at the same charge. Thus, automatically, costs per pound of Fruit were lowered. While I have no data on the matter, it can be pointed out that as costs dropped percentagewise per pound of Fruit, it allowed the price per pound of Fruit to also drop and yet register a net gain to growers.

This shift to a larger case eventually became 100 per cent for Israel in late 1930's, although only at times for Valencias and Lemons.

The markets' reaction to this shift was favourable in the sense that it was accepted. I have seen no data that in shifting from the "70" to the "74" the market was willing to pay more per pound of Fruit. In more recent years, the market has not been universally favourable to the large Israeli "74" case and in certain places Israel now offers the "70" case, not only for all Lemons and Valencias, but also for Shamoutis and Grapefruit.

This shift to the "70" case, even where accomplished, however, has not been completely successful. Two reasons can be assigned -

Handling Costs for Cases

First, the *charges per case* for freight and handling are apparently confused. The fact that costs per box do differ for the shipping Company can be ignored by the Citrus people if these costs differences are not charged to them. In consequence, costs per pound of Fruit to Citrus people can be greater in the "70" case than in the "74".

If, however, costs for freight and handling differ for the shipping and porterage companies, and that difference is charged to the Citrus Industry, then the specific difference should be so charged in any analysis. It may be that as a practical accounting matter many differences in charges cannot be carried on the books. Nevertheless, in an economic analysis, the differentiation should be made clear so that whoever reads it may make his own interpretation.

It is not easy to generalise as to relative costs in shipping and handling, as is shown in the following table -

CASE AND PORT	OCEAN FREIGHT	INLAND FREIGHT	LANDING CHARGES, DOCK DUES Etc.	CARTAGE FROM DOCKS	PITCHING AND PORTER-AGE	TOLL	DUTY		COMMIS-SION
							Ad.V.	Spec.	
"74" Size									
London	5/4½d		1/9d	6d	1¼d	1d	4/1d	2/11d	2/6d
Liverpool	5/4½d		-10d	6d	-	-	4/1d	2/11d	2/6d
Glasgow	5/4½d		-9½d	7d	-	-	4/1d	2/11d	2/6d
							Based on price of 50/-		
"70" Size		3½d per ton mile							
London	4/1½d		1/6d	5½d	1¼d	1d	3/3d	2/2d	2/-·
Liverpool	4/1½d		10d	5½d	-	-	3/3d	2/2d	2/-
Glasgow	4/1½d		9d	6d	-	-	3/3d	2/2d	2/-
							Based on price of 40/-		
Cartons									
London	2/4d		1/3d	3d	½d	1d	2/-½d	1/2d	1/3d
Liverpool	2/4d		8d	3d	-	-	2/-½d	1/2d	1/3d
Glasgow	2/4d		7d	3d	-	-	2/-½d	1/2d	1/3d
							Based on price of 25/-		

1. Toll is payable on Fruit sold in the Fruit Exchange, Spitalfields and in certain areas of Covent Garden.
2. Ad.V. - Ad Valorum rate - 1/10th of 90% of gross proceeds - paid 1st December to 31st March.
3. Spec. - Specification (3/6d per cwt.) paid 1st April to 30th November.

   The above dates are, of course, only examples.

Retail Market Price for Cases

The second point is less clear, but the claim is made that in certain situations a better return in the foreign market can be obtained in the larger case than in the smaller. Certain peculiarities of this point must be emphasized.

(a) A lesser price per pound could be justified in the larger case if the drop in price were smaller than the drop in cost already outlined.

(b) Particular emphasis needs to be given to the difficulty most people naturally have of handling the statistics associated with the matter. The larger case is one-third larger than the small, but the smaller

is one-quarter smaller than the large. Few people will master a ready handling of such percentage relationships and, in consequence, can have an imperfect appreciation and appraisal of the relationships involved. The price, for instance, to be equal must be one-third greater for the larger case than for the smaller.

This comparison of the two cases can, moreover, be made precisely for only one size. Namely, the "70" 252 is identical to the "74" 336. The "70" 176 is near the "74" 240 and the "70" 216 is near the "74" 294, but other sizes are not even close and require some nice interpolation to justify use.

(c) A principal gain to the "74" is ascribed to the large Fruit sizes. The advantage is said to arise because the market will pay a better price for Fruit of a specific size if a greater number is offered than a smaller number. The argument is purely of a psychological nature.

Any analysis of this argument is made difficult because the large sizes in the two cases cannot be compared directly. The sizes listed above in (b) as comparable were small sizes.

I have heard, for instance, the "70" 100 Shamouti compared with the "74" 150. The two cannot be compared since an exact counterpart in Fruit size of the "70" 100 would be close to a 133 in the "74" if there were such a size. As there is no such size the comparison of the price of the "70" 100 must be to a hypothetical price between that received for the "74" 120 and the "74" 150. It is only guess-work as to where the market would draw the line for a change in prices, between sizes. That is, if 45/- were paid for the 150 size and 40/- for the 120 size, what price might be paid for a 133 size half-way between, close to that of 45/- (paid for the 150) or 40/- (paid for the 120 size). Whatever figure was used it would be questionable and could not be proved to be accurate.

Consequently, statistical hazards are involved which require careful work if any comparison is to be accurate.

The analysis is also complicated by the assertion that it is very difficult for the retailer to sell large sizes. To further assert that the sale by the wholesaler to the retailers brings a better price by requiring the retailer to buy more at a time, is to me not logical. My impression of your retail market, from the few days' observation I made, was that the large sizes were the Fruits usually sold by the "piece" and that this practice was followed because of the difficulty in selling them. I find it difficult to picture a retailer being willing to pay more for these "piece" fruits because he can buy more at a time in a larger case. The hazards of decay and wilting and the need to increase the number of lines of sizes would go counter to it, and to me easily overcome whatever psychological reaction he may have to the larger number.

(d) A comparison of the two cases, to be statistically sound, must be in the same market at the same time with an identical background of experience. My understanding is that during the last 15 years the "70" case has been the strange one and, with the higher costs per pound of Fruit sometimes associated with its handling, has a serious handicap for introduction. Where both could be offered at the same time with an identical attitude of impartiality by buyers, we might have a practical basis for comparison, but I believe good market statisticians would be most circumspect in such a study.

OFFERING OF NEW CARTON

As matters now stand, the Citrus Board is in a position to offer new sizes and new dimensions of containers. To prepare a competent analysis of the problems arising in such a situation would require more time than is available, but the following points may be emphasised.

1. One container of a single fixed set of dimensions would appear to be necessary because of -

   (a) Marketing efficiency and reputation

   (b) Stacking efficiency

   (c) Equipment limitations. Experience thus far for instance, has demonstrated it is practically impossible to use more than one type carton in a sealer.

2. A simple size count relationship should be maintained between the old cases and the new carton. Roughly, this relationship has the following percentages to deal with -

   (a) The new carton may be ½ of the "70" or the "74" but not of both.

   (b) If it is ½ of the "70" it is ⅜ of the "74".

   (c) If it is ½ of the "74" it is 4/6 or ⅔ of the "70".

3. The stacking strength of cartons should be the maximum attainable for any given cost. Since stacking strength varies with size and shape a complex series of tests must be carried out before any rational decision can be made. While the methods involved are reasonably well known, they are unfortunately purely empirical and hence take considerable time. By and large, they are simply weight and time tests under defined humidity and temperature conditions.

   A complication when cartons of different size are tested is that the interest is not in the strength of a given carton but rather of the number of cartons which cover a given uniform area of the floor. There are more small cartons in an area 5 metres square than there are big ones; consequently, all the small ones together may be stronger than the big ones together covering the same area and hence support the same area load above. One frequently hears it is the corners which give a carton strength. Empirical testing on a considerable scale is the only practical way to arrive at an answer.

4. Ease of handling and stacking is necessary. The carton must be suitable for use in volume-fill equipment and in sealers. It must fit pallets, in trucks and railway wagons. It must stack so as to tie the load together with its weight.

   The key element in handling is how the worker will set it down. It should be light enough so he will set it down, not drop it.

5. What does carton cost in terms of the way the paper will cut, relative to amount of Fruit it will hold, and relative to stacking strength?

6. Relative effectiveness of Diphenyl may be decisive. Is Diphenyl less effective in a large container than in a small one?

7. What are contract charges for shipping and porterage? These charges can be highly complex but where shippers are experimenting with as radical a change as the carton, two questions should be asked -

   (a) What are the differences that may actually exist in the costs of different cartons?

   (b) Are there possibilities of lowering costs by careful purposive contracting with shippers and handlers before a final decision is made as to type of carton?

8. Do the smaller cartons offer any possibility of a consumer pack? It may be premature to raise this question, but if some information could be gathered on the matter and it were found there were some possibilities, it could be important. Retail costs would be reduced considerably if on occasion the entire package could be sold.

With volume-fill there is no easy way of determining the size of fruit in a carton, because you do not know how many fruit are in the carton. Thus in California, resort is made to counting out an occasional carton. On a size 300 Lemon where the minimum allowed is 150, the house probably aims at 155. If this number is the count after the carton has been shaken down and top dressed, all is well. But if the number is higher or lower by a number of Fruit, an adjustment is needed in the sizer.

After several years' operation, Californian leaders now want a counter at each fill station, not to give a count fill, but to serve as a guide on the sizing. The equipment wanted would give this fill of 155 suggested, and a glance at the carton would tell whether it would be high or low and what change should be made in the sizer. The problem is how to put in the counters without reducing the capacity of the equipment and without it costing too much. It need not be regarded as a necessary feature.

FILLING CARTONS

The following outline suggests the principal methods available for filling cartons:-

(i) Hand packing into pattern -

(a) From bins with Fruit mechanically sized by belt and roller equipment.

(b) From belts with Fruit unsized.

(c) From belts with Fruit sized mechanically.

(ii) Volume-fill. Shaker required -

(a) From roll board with Fruit mechanically sized on standard belt and roller equipment.

(b) From new modern sizers.

1. Operator control fill from belts.
2. Automatic control fill from belts.

System (i)(a) is now being used at Pardess in Petah Tikvah.

System (i)(b) would require no equipment other than a belt, stands, seats and carton conveyors. I recommend trying to size and pack at the same time.

System (i)(c) was described in the California Citrograph some years ago. It is very fast and low in cost. It may turn out to be the only practical system for Grapefruit and large Oranges.

System (ii)(a) is low in equipment cost in that the sizer can be converted back to regular use at any time. Yet the labour cost is low. The current issue of the Citrograph carries a detailed description of the method. My movie also shows many details. In California it is likely to become the most common volume-fill method for Oranges because houses already have the sizers and it permits volume-filling several grades at one time.

System (ii)(b)(1) until a few months ago was the popular one in California. It is now being converted over to the automatic filling stations. Both methods are shown in detail in my movie. Incidentally, the Cargal people have ordered a copy of my movie and it should be available here again soon. The Brogdex people forwarded a blueprint of their most recent design for Oranges and Mr. Gilutz and I modified it for descriptive purposes. (The Food Machinery Company and the Roberts Company both make similar equipment. Only Overstrom, however, make the shakers which will settle large fruit and Brogdex have an exclusive contract for its sale.)

Referring to this chart (distributed separately - Mr. Pintow, Mr. S. Gilutz, and Mr. Z. Brandstetter have copies) it may be helpful to review the process. Fruit on feeding conveyor (1) is ready for sizing and packing. From (1) Fruit ascends elevator (2) to sizer (3) through which it drops onto conveyor No.(4). The largest fruit passes over to conveyor (5). Each size is now on a belt enclosed by side boards. From (4) and (5) it goes over a roll board to conveyors (6) and (7) and still between side boards, each size group is guided into the respective fill station of each size (9).

Each fill station in this plan is automatically operated. The Fruit simply flows over the edge of the belt into the carton until a given weight is reached. When the weight actuates, a trip pushes the filled carton on and replaces it right behind with an empty one.

The fill, however, does not want to be thought of as a weight fill. The weight is adjusted for different Fruit weights so as to obtain a solid level fill of Fruit. A volume-fill is the objective.

The filled cartons pass over the automatic entry sections (10) into conveyors (14) and (15). These cartons on (14) pass over conveyor (16) and (18) to shaker (20). Those cartons on (15) pass over conveyor (17) and (19) to shaker (20). Two shakers are provided, one for large Fruit and one for small. The reason is that the top dresser on one shaker probably cannot do a good job fast enough for all the Fruit. Since large Fruit takes more time than small, they should be sent over separate shakers so the carton with large Fruit will not delay the carton with small Fruit.

With large Fruit the top dressing is a very important operation. (The movie describes it in some detail.) After some shaking almost always some Fruit has to be added or taken away. The top dressers must be provided with convenient supplies of Fruit of every size. Always the Fruit in the carton has to be moved in order to achieve a level fill. Then the flaps are held flat as the carton leaves the shaker.

Details of shaker operation will be described in some detail in a statement now being prepared in California.

A major question now exists as to whether an individual shaker should be provided at each fill station. Some think a better fill will be provided by that method. The advantage is not a clear one, however. Professor Perry, Mr. Fulton and I are preparing a memorandum on this topic and as soon as it is available I will forward you a copy.

From the shakers (20) the cartons pass over conveyor belts (21), (22) and (23) to the sealing machine (24).

Back to the sizer, conveyor belts (11) and (12) and elevator (13) may have been noticed. As shown on View 13 Fruit from conveyor belts (4) pass over a roll board to conveyor belts (6) and (7). This roll board is fitted with trap doors, one for each size, which, if the

the operator sets them, divert the Fruit of each respective size down onto belt 11 (shown by error as 13 in View B). The Fruit passes over conveyor belt (12) onto diverted fruit roller elevator (13). In this way, management can, at will, divert any size it wishes from the volume-fill operation.

The carton folding stations are at (8) and the folded boxes are carried by belt underneath the sizer and Fruit distribution belt to the automatic fill stations.

With proper equipment, I estimate that 4 or 5 girls can fold all the boxes necessary. While we have not had very much experience, 1 and at most 2 girls are all that will be required at shaker. A foreman must be on hand to supervise and particularly set the shaker and set the weights on the automatic fill stations. He would have an assistant counting Fruit for determining the size count relationships. Someone must be stacking off cartons and on occasion someone must bring in cartons for flats. If the Fruit came in bulk bins a fork truck operator would be feeding them into the dump. A maximum of 12 people would appear capable of handling this entire operation.

This volume-fill technique is universal with California Lemons, but it is not yet a generally accepted system for Oranges. As has been pointed out, temperature difficulties have slowed the use of cartons in Oranges. Settling and top dressing difficulties have also hindered its use. One installation has been a complete failure; one only a partial success the Fruit often being damaged because of improper top dressing; one has been successful; and another has just started.

CARTON SEALING

Perhaps the most surprising thing about the sealer is that both top and bottom flaps are glued after filling. The inside flaps hold the Fruit in, while glue is applied to the outer flaps. The sealer is made up of two parts, a glueing unit and a compression unit. It is a completely automatic machine and the standard Knapp machine used in California operates with no problems whatever.

There is always an argument as to what glue to use. I have turned over to Mr. Pintow the data I have on types of glue.

There is no substitute for an automatic sealer. However, if I were setting up an operation without an automatic sealer, I would still use glue exclusively as the sealing device. Frames such as you now use are necessary and I would have enough made so that some dozen or so stacks of cartons could be in frames at one time. By stacking one on top of the other and the use of weights for the top box, my observation is that a good job of glueing can be done without excessive cost.

STACKING CARTONS

Cartons should be handled as little as possible since a broken corrugation weakens it materially. California operators are all turning to the use of pallets. The pallets have a solid floor and are of just the exact size to hold the stacks of cartons arranged in whatever form the management requires. In some instances, success has been achieved in conveying these pallet loads directly into the railway cars. The width of the car door opening is the only hindrance.

FOLDING CARTONS

By folding cartons is meant the squaring up of the flats and folding in of the bottom flaps so they will hold Fruit. The collar is inserted and if separate Diphenyl sheets are used, the bottom one is inserted. If a telescope carton is used, the two parts are fitted together at this time.

Two methods are available as to the position and the person for this folding. In one, the cartons are folded at the filling stations by the filling station operator; in the other at a special folding centre, by a person who does nothing else. The latter system is the only practical system for filling systems (ii)(b). This applies whether the filling station is controlled automatically or by an operator. Separation of the tasks seems to improve efficiency. For one thing, the person folding cartons can handle several size folding positions at a time. The same is often true at filling stations.

For the other filling systems, however, those marked (i)(a), (i)(b), (i)(c) and (ii)(b), there are differences of opinion. Some managements have constructed special filling folding stations and have long conveyor chutes to the various stations. My own opinion is that the folding can best be done by the operator of the fill station. Actually, if the arrangements are made properly, it takes very little, if any more, of her time than the other system, and eliminates a complex of chutes and cartons scattered over the packing area.

For the cartons to be folded by the filling station operator, certain specifications need to be followed closely -

(a) There should be room for one extra folded carton ready for filling besides the one in the filling station.

(b) There *must* be a specific *place* for a bundle of flats at each size fill station. These flats *must, if at all possible,* be stamped ahead of folding. Supplementary *places must* be arranged for collars, Diphenyl sheets etc., although these items need not be provided specially for each size station.

When a carton has been filled and the operator has shunted it away and placed the reserve carton into place for the next filling, all she needs to do is turn to the bundle of flats, fold a carton and place it into position. It takes no longer than reaching for a carton already folded, reaching for a stamp, inking it, stamping the carton, replacing the stamp, and then placing the carton into its reserve position.

Efficiency in folding is not as easily achieved as some think. A study is near completion on this topic and as soon as possible I will forward the report.

STAMPING CARTONS

It has already been indicated that carton stamping should be done ahead of folding. If a bundle of flats are placed in proper position, the whole bunch can be stamped almost as quickly as one. With a special *place* for each bundle at each size station, error in stamping is virtually eliminated.

4 - FRUIT TREATMENT AS RELATED TO NEW PACKAGING AND HANDLING METHODS

Some special justification is required for a statement on this problem by one in my field.

It rests on two grounds. First, the radical changes in handling practices now being made available to the Citrus Industry, makes possible some changes in Fruit treatment to which attention should be drawn. Second, the development of these new handling practices has required a careful appraisal of the market reaction and, in consequence, there was afforded an opportunity to observe the effects of various treatments. Nevertheless, I wish to emphasize that groups such as that headed by Dr. Littaur are far more competent in dealing with matters of this nature.

My assumption is that if the carton were used the wrap would be eliminated. In this change there is the greatest clear advantage both in the packing-house and in the retail store. In consequence, however, Israel faces some important changes in its Fruit treatment practices.

For one thing, clean Fruit will have a greater advantage than before. As a carton is opened, the entire top layer is at once open to view. However, this whole question of washing is outside my field of review.

More important, one of the two prime factors in decay control-the Diphenyl wrap-is removed. While my impression is that in California the use of Diphenyl in the tight carton is regarded as more effective than on the wrapper in a ventilated case, the matter, so far as I know, has never been subjected to careful test. In any case, it is open to question in Israel. At the very best, there is no reason for thinking that the present wastage of 1 or 2 per cent will be reduced without other changes also being introduced.

The present packaging, whether of wooden case wrapped or carton wrapped has two serious defects, first of wastage equal to 1 or 2 per cent, and second of shrinkage resulting in a slack pack. *In the proposed naked carton pack, these two defects could easily be more serious than they are to-day.*, Certainly, they show up more seriously to the buyer. Also the slack weakens the carton for stacking and wastes space in the carton and in the ship.

The technical information on packaging and handling which is involved here is in four categories, as follows -

1. Packaging can be made almost entirely mechanical and its space and labour requirements are nominal.

2. Cooling techniques are low in cost and have small space requirements.

   (a) Hydro-cooling is an in-line operation which requires no labour. Dowacide A decay control might serve as a second treating process.

   (b) Bulk air cooling requires space for storage comparable in time to that required for Decco treatment. The two might be combined. It might also be used as a dry air treatment to endure faster initial shrinkage.

3. Moving Fruit in bulk bins is a very low cost operation when properly set up. A serious investigation is needed of the various designs that are available but their practicality and low cost can be assumed as certain.

4. I assume that a ship, once solidly packed with Fruit in tight cartons, can be so handled that the Fruit will not heat up to any dangerous degree. Refrigerated ships would not appear to be practical. The only suggestion I have to make is that care be taken to keep the deck and sides of the ship in the direct rays of the sun from heating up the Fruit. By the proper use of air ventilation devices it would seem quite practical to maintain a separation between the Fruit on the one hand and the ships' sides and decks on the other. Refrigerated air might be helpful but not necessary. Night air cooling and circulation of air within the ship during the day should be enough. I am completely unacquainted with ships myself so I can easily be wrong. I am impressed, however, with the capabilities of the ship Masters I have met and would urge a cooperative study with them. Dr. Ophen's use of thermo-couple for temperature readings might well establish this point in a short time.

Initial shrinkage with which I am concerned is primarily a problem with the Shamouti and is very fast at first. My understanding is that it can be achieved with no loss of individual Fruit appearance and no loss in eating characteristics. I also understand that decay control must be initiated before it has gone very far or serious decay losses will occur. If the Fruit were treated shortly after picking, either with Decco or with Borax and then packed directly into Diphenyl treated cartons, there may be no added decay problem; but it is pretty well established that the initial shrinkage which occurs leaves such a pack with the serious fault of being slack. *The treating problem, as I see it, is how to use the available decay control methods so as to allow a delay in packaging until the most serious of the initial shrinkage has occurred.*

The suggestion put forward is - to treat the Fruit as soon as needed in your central houses, and again just before packaging after the initial shrinkage has been achieved. Where excessive time intervals occur extra treatments may be in order either before or after packaging. Just what specific treatment or combination of treatments would be best, I do not know. The Decco process, the Borax process and the Dowacide A process if the Fruit is hydro-cooled, all appear to merit the most careful consideration.

In summation, the question is how to prevent decay from developing while the Fruit is kept out of the Diphenyl treated carton, something which apparently must be done until the initial shrinkage has occurred.

Since this initial shrinkage requires some time, say 2 to 3 days, a choice is open to the industry whether to hold the Fruit in the new central packing houses, or to simply wash and grade the Fruit at these points and haul to the ports for packaging. *Apparently this latter procedure would give time for the initial shrinkage to take place without imposing an additional time interval on the Fruit between picking and consumption.*

Packaging at the port then presents an *opportunity* for the industry to obtain the time necessary for initial shrinkage without increasing the time necessary for marketing.

Decay Control. My impression is that while this initial shrinkage is occurring there also is taking place some of the decay process which results in the wastage you now experience. As the Fruit is fed into the packaging system at the port, it would be very easy to grade out rotted Fruit and contacts. (Contacts are Fruits on which spores have settled and which, in California, are regarded as more susceptible to decay and hence should not be packed). Some improvement might even be made in eliminating Fruit damaged by the Mediterranean Fly.

Temperature Control. I do not know what relation exists between temperature on the one hand and the initial shrinkage of the Shamouti on the other. When I came, I assumed that your Fruit, like our California Fruit, would respond to lower temperatures with less shrinkage and less decay. With your Shamouti, however, it would appear desirable to allow the initial shrinkage to take place even if it might be slowed. Consequently, temperature control would appear to take a secondary place to initial shrinkage in the handling of the Fruit.

However, even with the initial shrinkage of the Shamouti recognised as an independent requirement, temperature control would still appear to be something to look into. Without reference to cooling to 4°C but only to 10°C or higher, the following improvements might be achieved -

1. Less deterioration in the ports when Fruit piles up for lack of ships.

2. Less decay in the whole marketing process.

3. Less shrinkage and wilting in the carton. (I assume initial shrinkage to have occurred.)

4. Better eating characteristics. My impression is that cooler storage greatly improves the taste of Fruit which takes weeks to reach the market.

A study of temperature control may reveal that it should be initiated at an earlier point, say, as soon as the Fruit can be brought to the central houses. In fact, I dare say, it is already recognized as good practice to keep the Fruit out of the sun. With milk and eggs, about which some excellent studies have been made, the quickness of application is recognized as of the first importance.

In the houses where I have worked, even on your hot days, there would appear to be no great difficulty in assuring some degree of temperature control, though I have no information to justify suggesting any specific level. Pertinent to any such control system, however, I should like to bring to your attention two points.

(a) The substitution of cartons for wooden cases greatly reduces the storage space required. While a bulk tin system for hauling Fruit to the ports would require some space I assume they either would rest or be collapsible so would not take too much space.

(b) The new techniques reduce your labour load requirements to a fraction you now use. In consequence of such a reduction, a more exacting feed through of Fruit can be achieved so it need not be allowed to pile up and fill storage space.

These two points would appear to me to make it easier to achieve temperature control in the central houses, regardless of whether the packing is done there or at the port. A roof would be easier to keep over the Fruit. Protection from hot winds would be easier. Even tight walls with a degree of evaporative cooling would appear practical.

Keeping the Fruit cool between the central houses and the ports poses a more difficult problem. However, it would not appear to be hopeless. As I see it, it can well be regarded as a necessity whether the Fruit is hauled already packed, or hauled in bulk bins. The only hesitation that I can see justified is that based on the belief that the Fruit is already cool enough or that cooling would interfere with desirable initial shrinkage. As to this last point, *humidity control would have more to do with initial shrinkage than would any specific temperature level.*

SUMMARY

Again I wish to apologise for presuming to make these suggestions in a field in which I have such slight training. The point arises, however, that the new handling, packaging and cooling techniques open the way to new treating processes. Either field can point the way to needed investigation and the greatest danger to be avoided is the assumption that something cannot be done because of a factor which is foreign to one's own competence and which is held up as an obstacle simply as a matter of general repute. This comment applies as much to business men as to research workers.

Obviously a very careful investigation, both basic and applied, is required before a decision can be reached on a matter of such import. My whole objective in writing this memorandum is to raise questions, not to decide them. But let me repeat. It would be very desirable to eliminate the wastage and shrinkage from your present pack.

5 - GENERAL HANDLING METHODS

PACKAGING AT THE PORT

Throughout my survey here in Israel it has been obvious that an important alternative system for handling Fruit was packaging at the ports. The reason for the suggestion is a matter of Fruit treatment which is discussed in another memorandum. The suggestion is not new except that in earlier investigations it was apparently assumed that washing and grading would be carried on there also, a proposition that does not appear to me to be very practical. The earlier plans also assumed packaging into the wooden case with wraps, which requires a large number of labourers to be on hand, and also requires a great deal of space.

While I do not want to be arbitrary, my thinking has been that washing and grading could best be carried out under the plans now being developed at central houses. Primarily I have assumed that some kind of Fruit treatment was necessary much sooner than could be assured at the port. Also, by having the main grading done at the central houses, Management would divert an important part of the Fruit - the lower grades - from the ports where it was not wanted. I also felt that the field boxes in use were an extremely inefficient shipping unit, being expensive to build and use, and damaging to the Fruit.

Questions of space and labour were the only technical questions raised as an argument against these port operations. I hoped to arrange for a careful survey of the port with its Management, but apparently it was not possible. I had parts of three days there, however, and had some liberty to wander around and observe operations. One can say definitely, the assumption made by others that packaging at the port would require more labour and more space, is simply wrong.

As to space, the new large scale packaging machines as described elsewhere take very little room. The space now occupied by the inspection services could easily turn out one or two thousand cartons an hour. Bulk bins could be stacked far higher and far more safely than wooden cases are at present. The bulk bins could be fed into and out of the warehouse more efficiently than are the present cases. For one thing, no repairs would have to be made there.

If necessary, the packing equipment could easily be installed on a second floor. It is not as practical, but it can be done, several such installations being in existence in California.

Moreover, the cartons packaged at Haifa can be fed directly from the sealer into the ship by overhead conveyors, eliminating thereby all the space now needed for trucks, dollies and other dock side loading devices in use. This is not a new suggestion but with cartons moving direct from the sealer, the efficiency is so obvious that the method becomes not simply an opportunity but a necessary procedure.

Not all Fruit could, of course, be so handled. Packaging and loading would not be synchronized perfectly. It would seem to me, however, that the greater percentage of your Fruit could be so handled.

The saving in labour is clear. Where the cartons go directly from sealer to ship, not one man would be needed between the sealer and the hold of the ship. Within the ship I am confident that cartons will require less labour than do wooden cases. There would be no labour needed for repair as now required on receipt of cases at the warehouses, in the warehouses, on the docks, and in the ships.

The only technical handling question I can see of any moment is loading and unloading bulk bins from railway wagons with industrial fork trucks. With road lorries there is no problem and I suggest your investigations start with the assumption that road lorries do offer a clear opportunity in this regard. With bulk bins on road lorries, we can safely assume a material reduction in labour requirements for receiving fruit into the warehouses.

Moreover, fork trucks unloading from road lorries is so fast that the unloading time of the lorries at the warehouse would be reduced to a fraction of what it is now; here again saving space for lorries and time for drivers.

It would have been interesting and perhaps highly pertinent to have examined the organisational problems involved. Peculiarly enough this suggestion of packaging at the port presents problems which probably lie more exactly within my special field of research than have any other problems that I have encountered here. Since I could not go into the problem in detail, the only comment I feel I need to make is that if you have a good organisation it should find no difficulty in adjusting itself to the technical needs outlined here.

The object of this suggestion of port packaging has to do with what is desirable Fruit treatment. If Fruit treatment can be improved by packaging at the port, better do it there. If the best results in Fruit quality can be achieved by packing at central houses, do it there. Relative cost factors may change this conclusion but it would be hazardous to estimate them at this juncture.

BULK BINS

In any discussion of packaging at the ports, one question which was always raised was how to get the Fruit to the port.

Three methods were suggested;

in bulk,
in field boxes,
in bulk bins.

Handling in bulk merits consideration but the difficulties of filling and emptying road lorries or railway wagons, and particularly of accumulating and storing at either end of the trip, makes it difficult for me to visualise the system in practice.

Field boxes are not practical. They are expensive to build and to use, they damage the Fruit, and I assume they would be emptied at your central houses where the Fruit would be washed and graded,

The term bulk bins is a very broad category. A great deal of work has yet to be done in design. However, certain characteristics can be defined. The bin would be handled by industrial fork trucks which some of you now use. The dimensions are pretty well set as to length and width by what can be fitted most efficiently into your railway wagons and road lorries. The latter appear to offer no problems but railway wagons with their narrow doors pose some difficulties. Apropos of this loading into wagons, I would like to point out that there are now available many different types of transport units for such purposes, and some would no doubt be more adaptable than others.

The depth of the bin would certainly be a metre as far as the Fruit is concerned, but it would be determined by the need to fully fill a railway wagon.

At the request of the California Citrus Industry Research Association; the University of California, Department of Agricultural Engineering is making a detailed study of means of dumping bulk bins automatically. As information becomes available, I shall forward it to you. In any case, use of gates in the bins is practical and some fork trucks are so designed as to be capable of emptying material from bins.

To keep the cost of return to a reasonable level, the bins would need either to be collapsible or to be nested.

Designs that I have seen permit stacking to almost any level.

Almost any material can be used in such equipment; the relative costs of each one, however, when depreciation is taken into account, becomes a very complex problem. One factor which should be considered is resistance to corrosion by Decco.

If a round hard paper or hard board drum could be designed which would nest, I suspect it would be most satisfactory. It would not damage the Fruit and is non-corrosive. It is low in cost. Moreover, it might serve admirably in orchard operation and then serve a double purpose. We are doing some work along this line and as it progresses I shall keep you informed.

USE OF PALLETS FOR CARTONS

The advantage of using pallets for cartons is recognised by all packing house operators in California. The industrial world uses them more and more. Even chain store managers often speak of their wish to have produce delivered into their store on pallets. The method saves labour, is clean, and it reduces injury to the containers.

Your Industry is already acquainted with the advantages of pallets, using them as you do in hauling field boxes, cases, etc. If you should find that cartons are a desirable method of shipping Citrus, and if you should find it best to package at your own central houses, pallets could be very important.

The main objection to pallets in shipping is the cost of return. It hardly applies, however, to Israeli Citrus with its short distances between packing houses and ports.

For road lorries I see little difficulty. The Industry is already well acquainted with the techniques involved.

For railway wagons the problems of loading and unloading are much more difficult. While there are many types of transport units for handling pallets, it may be very difficult to get a pallet load into and out of a wagon. It may be even more difficult to fill the wagon properly. I understand the rate charged by the railway is so much per wagon, so one can easily see why they are so carefully filled. It may be practical to modify this fill in order to gain the advantage of using pallets. Careful design of the pallets and of pallet loading would go far to help fill the car.

I recommend a thorough study of the use of pallets to be used with cartons.

BARGE OPERATIONS AT JAFFA

In examining the barge system in use at Jaffa relative to the potential use of cartons, the question arose as to whether the cartons might not be left on pallets while en route to the ship. The method might not be too important if cartons came to the dockside without pallets as from a sealer direct, for they could be slid down into the barge by chute. However, hand-handling in the barge is apt to cause damage.

We were told at the port that the idea of leaving containers on pallets in the barge had been tried but abandoned because they could not get on as big a load. My understanding is that they used their regular pallet and sling arrangement which requires space on all four sides, particularly on two opposite sides, the latter so a man can get in and attach the slings. Also they could have had trouble in stacking to their usual height.

The suggestion I have is to use a modified form of bull hook. The top and back side and bottom would be square so as to fit back and down the side of the load and slip easily into the pallet skid. The bottom parts would appear identical to the lift forks on an industrial truck. I should judge it best to keep the arrangement of the hook so that the load will hang straight, not tipped back.

For safety in the air, a light supplementary sling could be slung over the front of the load and fastened to the front end of the forks. In this respect the operation would be identical to present slings. A separator should be provided at the top to prevent the front sling from pulling into the load.

To hold the cartons in place it would seem wise to have a rope net thrown over each pallet load and left there until unloaded on the ship. Or a canvas could be so used and thus protect the cartons from spray.

For loading, this bull hook fork arm arrangement would permit the crane operator (with the help of a man on the barge) to slip or skid the pallet load into any narrow place if it were just wide enough for the pallet load. By detaching the front slings after reaching the barge but before slipping the load into position, the pallet could be skidded right into a corner, then the bull hook fork arm arrangement could be withdrawn.

In this loading arrangement, I assume that the barge, being in the dock, will be very steady. I also assume, perhaps, too careful a control by the crane operator. Possibly some modification of the crane equipment and its operation would be necessary.

Unloading would be the exact opposite procedure. The fork arms would be slipped under the pallet load by the barge man. In a quiet sea the crane operator might help pull the pallet load back so the front slings could be attached. In a rough sea, the barge man would have to be able to move a pallet load without help from the ship. Just how, I do not know, but since it would always be toward the barge's centre, a tackle arrangement might be feasible. Once the pallet load had been moved back from its tight corner position, the bull hook fork arm arrangement in place and the front slings attached; I see no difficulty in the crane operator swinging the pallet load free of the barge.

As on a truck, both the design of pallet load and of barge may require some modification so as to allow a full load to be carried. I noticed on the barges that there was a broad middle space from two to three metres wide clear across the barge, apparently to allow for stacking of cases on slings. I see no reason in the proposed system why this space

could not be filled. Since the modified bull hook is a specialised item, a ship would not have one. So the barge would carry them out and for this purpose, in loading, the last pallet load could be set down with front slings attached and no particularly wide space left on any side. In a rough sea, swinging the bull hook back for the next load might cause difficulty - I am not sure.

I see no reason for thinking that such a barge load would be materially less than those now carried. With no handling of individual cartons in the barge itself, the system would be economical of labour. Finally, handling of individual cartons would be reduced, thus causing less injury to them.

ROAD LORRY DELIVERY DOCK SIDE TO SHIPS

If the proposed packaging system is found to be as practical as indicated and if port warehouse packaging does not seem feasible, the palletising of cartons and the use of road lorries with trailers may make it practical to largely reduce and perhaps eliminate the port warehouse system for Citrus.

The modern road lorry trailer system makes it possible to move great quantities of material with great speed if loading and unloading can be accomplished with facility.

Pallets encourage this speed. The bull hook fork arm arrangement suggested for Jaffa barges might very well be applied to dock side loading at Haifa. The advantages are that the pallets are less expensive and the lorry load can be solid. If slings have to be attached as at present, space must be left for a man to reach each pallet on two opposite sides.

Or the pallet loads might be unloaded by a regular industrial fork truck and the bull hook fork arm arrangement then used.

There appears every reason to think the lorry trailers could be unloaded with great speed.

The packing houses might be the present central houses or be new places located close to the port but outside of the congested areas.

If close to the port, an advantage would be gained in temperature control for the Fruit over the opportunity afforded at your central houses. With the proposed palletised road lorry trailer system, a packing shed within five miles of the port could achieve an efficiency of delivery dockside that would keep costs at a very low level indeed. Avoidance of the congested area would naturally permit greater freedom in design and more specialisation in equipment than would be practical at the port warehouses. I recommend a careful appraisal of this system.

6 - TEMPERATURE CONTROL

The term *"temperature control"* is selected because it implies not a system of refrigeration, but rather the control of temperature without specification of the means. Just keeping Fruit out of the sun is an example of temperature control.

Traditionally, any mention of cooling has been interpreted as refrigeration and in the case of Oranges it has meant a huge plant with heavy insulated walls, expensive machinery and very slow cooling. Temperature aimed at varied from 4°C. to near freezing. A number of these plants were built in California in earlier years, but had largely fallen into disuse because the modern refrigerated cars were more economical.

With the proposal that a carton be used we recognised that the refrigerated fan car, while efficient with ventilated wooden cases, would not be so effective with the carton which was tight and insulating.

The prime technical reason for the more rapid conversion in California of Lemons to cartons than of Oranges was that Lemons, in packing, came out of storage at an ideal temperature for shipping, about 14°C. Both decay control, particularly with Diphenyl, and freshness were best maintained at that temperature. Consequently, an advantage in shipping was immediately achieved by putting the Fruit into a tight insulating carton in which there would be little air movement, good humidity relationships, and slow temperature changes. The situation was so ideal that the cost of ice for shipping to the East coast was cut in half. The old system with its heavy expenditures for ice had had the defect of cooling the Fruit too much. No doubt the greater stability of humidity and temperature in the carton contributed to the greater freshness of the Fruit in the market, which all observers immediately noticed.

With California Oranges, the situation was very different. Temperatures at the time of packing varied from 20°C. to 40°C. As I emphasised on my arrival, in California all agreed that some sort of temperature control is necessary at levels below those now existing at packing time.

The first successful development was at the Placentia Orange Growers Association. (It was reported, in some detail, about two years ago in the Californian Citrograph.) An old precooler unit was modernized with more exact temperature and humidity controls and with provision for moving air rapidly about cartons of Fruit. The cooling is done after packaging and takes about 40 hours. Temperatures aimed at are about 4°C. Loading in refrigerator cars is solid and only a little ice is required, just to keep the outside temperatures from heating the Fruit. I believe all are agreed that it represents the best Orange packaging in America. One is tempted to recommend it without qualification, but it has certain defects -

(a) the heavy expense for installation

(b) time required of two days

(c) the inefficiency of trying to cool through the carton wall. The carton itself is probably weakened to some degree by the treatment involved.

The objectives aimed at in temperature control are in two main categories. *Decay control* and *Freshness.* By freshness, I have in mind good bright appearance, firmness and good taste. My understanding is that in the past a temperature at least as low as 8°C. was considered necessary in order to prevent moulds from spreading. With Diphenyl this requirement, I think, can be considered much less important.

As to freshness, I have seen little definitive analysis. Other variables than temperature such as age, humidity and simple air movement play an important part. The reaction of the Fruit when refrigeration is withdrawn may be important; the final test of the Fruit is not at the Warehouse, but when the consumer eats it. Since the Wholesale shop, the Retail Store and the home probably keep the Fruit at normal atmospheric temperatures, it may not be best to drop the Fruit to very low temperatures temporarily. Quickness of cooling may be important. I feel quite certain that keeping Fruit cool helps in maintaining freshness but suggest we need more information on the temperature levels needed to achieve it and on the comparative economic value and costs involved.

SYSTEMS OF COOLING

There are several different systems of temperature control. The source for cooling may be the ambient temperature levels, evaporative cooling equipment, or mechanical refrigeration. I can visualise all playing a part in the solution of the Orange problem.

Ambient Temperature

The use of ambient temperatures can best be described, I think, under the term operational methods. I am quite sure that something can be done without the use of any special equipment. As mentioned, keeping the Fruit out of the sun will help. The Fruit should also be shielded from hot winds.

Night air cooling may be very helpful. It simply means arranging stacks of Fruit so air will move freely around them, letting it in at night when it is cold. The Warehouse should be kept closed during the day.

Evaporative Cooling

The use of some simple evaporative cooling devices might be of real help. An analysis should be made of the meteorological data you have available before drawing any conclusions but apparently your hot days are days of hot dry winds when evaporative systems would be most effective.

The equipment is used with success by many California Lemon storage houses although mechanical refrigeration is considered better. I see no situation in Israel, however, which poses a problem as exacting as the storage of Lemons in California.

Evaporative cooling devices in a frame building might be useful enough if all that is wanted is the maintenance of the cold acquired at night and it might be used to hold temperatures below the level otherwise obtainable. It might also be used on railway waggons and road lorries for the same purpose.

New Systems:

The demand in California for a method of cooling Oranges more economically and more quickly has led us to carry on several exhaustive investigations of new methods of cooling, resulting in my opinion in some very real success; although it is too early yet to find any commercial adaptations.

The new methods are as follows -

(i) Hydro-cooling
(ii) Bulk air cooling
(iii) Forced vent cooling in cartons

Hydro-cooling:

Hydro-cooling was developed about thirty years ago as a device for cooling Lemons by immersion in cold water. It long since has been converted into a flooding system in which the cold water is poured down over the product and pumped again from the tank below to the flooding unit above. This circulation is very fast. As a first trial I would suggest a rate of 20 gallons a minute per square foot of product. The hydro-cooling machine has a conveyor about 6 feet wide and as long as needed to obtain the time required for cooling the volume of product being fed through. To cool Oranges from 20°C. to 10°C. would take about 18 minutes at the rate of flow mentioned with water at 1°C.

A great many products are now hydro-cooled, most notable of which are Peaches in South-east U.S. Here the entire crop is so treated, the most notable advantage being that the growers can delay picking about two days because of the quick and effective cooling, resulting in delivery of a better quality product to the market.

In applying the system to Oranges we have found technical problems which must be correctly handled. As far as I know, however, there are methods of hydro-cooling Oranges which can be relied upon to cool without damaging the Fruit. Obviously the method would need to be tested thoroughly before being commercially applied.

Hydro-cooling is an "in line" operation and hence need impose no labour cost. In terms of hours of use and capacity it is much the lowest cost system proposed, both as to installation and also as to operating cost. It could best be used just ahead of sizing and packaging but it might also be used after the washing, waxing and grading operation, without reference to packaging, if the two phases of Citrus Fruit operation were separated.

Bulk Bin Air Cooling:

The bulk bin air cooling system is primarily a paper plan, although its simplicity is such that the work required on it is purely one of design. Bulk bins would be used and as pointed out elsewhere, some serious design engineering would appear to be justified. The sides would be of mesh to allow for the free circulation of cold air. The width would be determined by findings as to rate and extent of cooling for Fruit piled at various widths. The filled bins would be stacked solid across a room and cold air forced through the bins from one part of the room to the next. Adequate cooling, I should think, could be achieved in from 6 to 12 hours.

The bulk bin system in part, is an outgrowth of some old suggestion about the use of a cold air tunnel. The tunnel system could be made to work, I am sure, but the bin system appears to me to be more economical in terms of equipment.

It has one advantage over the hydro-cooling system - it could be set up to operate on a 24 hour basis, even though other operations in the plant were restricted to 8 hours. The 24 hour operation would save much in the investment of compressors and similar items. It is not, however, an "in line" operation and not so flexible. It also requires extra handling of the Fruit although, with proper design, this point could be of no importance at all.

The bulk bin cooling system appears to have many advantages over the pre-cooling rooms now in use in California or in South Africa. The room area required is far less. Cooling is more efficient, quicker and more flexible.

An important point for Israel is that it might be tied in with a method for inducing faster initial shrinkage for Shamoutis. The system could also be tied in with the application of Decco.

Forced Vent Cooling in Cartons:

The third new method of cooling has been worked out to some extent by Professor Perry of the University of California, Department of Agricultural Engineering at U.C.S.A. As with the established pre-cooling system, it is to be applied after the Fruit is packed but with vents provided in the cartons and the cartons so arranged that cold air is forced through the carton vents. Handling and stocking the cartons would be carried out in a method similar to that suggested for bulk bins. Without doubt, Professor Perry has established that cooling can be very fast in such a system, only a fraction of the time now required in pre-coolers. The advantage of the system would be that there would be no extra handling of the Fruit as in the other two suggestions.

It is not practical here to attempt any further description of these cooling methods. In the main the detailed design and testing has been completed and some of it has already been made available to you. As more information becomes available it will be forwarded. The most important part, however, the effect of these various systems on the quality of your deliveries, will have to be worked out by yourselves.

The problem of temperature control that I see for Israeli Citrus is that you have no definitive information as to what temperature you seek to achieve. The problem is largely identical with California's, except that we have to start with far higher levels which we are all sure must be lowered. It may be that your temperatures, apparently ranging from 10°C. to 20°C. and perhaps higher, are all that could be desired. The importance of quality deliveries, however, is such that a very careful determination should be made of what objectives are desirable. If temperatures other than those you now obtain are found to be needed, the economy of modern cooling techniques are such as to make it foolish to delay finding out what the right answer may be.

7 - NEW GRADING TABLE

Some of you have seen the movie of our new grading table. A description of it also appears in the current issue of "California Citrograph", so no further description is needed here.

I have turned over to Mr. Pintow a copy of the drawings and specifications. Mr. Jack Kaly is well acquainted with the techniques involved. He has worked under Professor De Garmo who carried on some of the basic studies required and, in consequence, knows the motion principles which are used.

My own reaction is that with your Mediterranean Fruit Fly and other wastage problems, a careful appraisal of the potentialities of this machine would be justified.

In the meantime, several complete installations have been installed or are being installed in California. Also, a special test is now underway on Navels. As soon as further information is available from these various sources, I will forward the results to you.

8 - MARKETING RESEARCH FOR CITRUS FRUIT

It is apparent that a major research programme in Marketing Citrus Fruit is ahead for the Israeli Industry and it may not be amiss to draw your attention to the more recent developments in research organisation that has taken place in California. An important part is carried on by co-operative arrangements between various research organisations, such as that of the University and the United States Department of Agriculture on the one hand and the Citrus Industry Research Association on the other. This association was originally set up as the Ventura County Citrus Growers' Committee, sub-committee on Research, in 1944. While each of the three marketing associations have one member on the Board of Directors, the remainder of the some twenty-five members are divided equally between growers and packing-house managers. Each person is chosen on the basis of his interest in, and willingness to give attention to, research. Some accomplishments may be listed as follows:-

1. Incentive wage system for Lemon picking which automatically adjusts for yield, tree height, etc.

   In co-operation with U.C. Department of Agricultural Economics.

   Now covers an annual wage bill of three million dollars.

2. Similar wage study of Oranges.

   Not recommended but used by some houses.

3. Photocell sizing of long fruit as Lemons.

   In co-operation with U.C. Department of Agricultural Engineering.

   Will be commercially available in short time.
   Extremely accurate.

4. Photocell colour sorting of Lemons.

   In co-operation with U.C. Department of Agricultural Engineering.

   Contracts completed by Food Machinery and Chemical Corporation for commercial installation.

5. Sampling system.

   In co-operation with U.C. Departments of Agricultural Economics and of Agricultural Engineering.

   In use by all co-operative Lemon associations.

6. Development of transparent wraps and of mechanical wrapping.

   In co-operation with U.C. Department of Agricultural Economics, Goodyear Tyre and Rubber Corporation and Hudson Sharp Wrapping Machine Co.

   Some hundreds of cars of such Fruit were shipped but it was abandoned in favour of the naked pack.

7. Development of shaker pack and of volume-fill technique of measuring fill.

   In co-operation with U.C. Department of Agricultural Economics, Hewitt Robins Inc., Overstrom and Sons Inc., Brogdex Inc., and others.

   In universal use in Lemons and established as practical in Oranges.

   A most elaborate study now underway with U.C. Department of Engineering.

8. Corrugated paper carton (½ box) for Lemons and Oranges.

In co-operation with U.C. Department of Agricultural Economics and International Paper Co.

All Lemons now so shipped and over one-third of Oranges.

9. New cooling techniques:

(a) In carton with pre-cooler, *in co-operation with U.C. Department of Agricultural Economics, Sunkist Inc., U.S. Department of Agriculture at Pomona, and Plocentia Orange Growers Association.*

Oranges so packed now top U.S. market.

(b) In bulk by hydro-cooling. *In co-operation with U.C. Department of Agricultural Economics and of Agricultural Engineering, Union Ice Company, Food Machinery and Chemical corporation, and Orchard Supply Distributors.*

Established as feasible and very low in cost.

10. Mechanisation of Picking.

In co-operation with Department of Agricultural Economics and of Agricultural Engineering and Yale and Towne Inc.

Material progress made in a very difficult subject.
Commercial installation now being studied as to certain phases.

It must be emphasized that the Research Association attempts no research itself. Neither does it attempt to direct research. The research personnel from the co-operative groups are always in charge and responsible for any decision made. That does not mean however, the work of the Association is obscure. Quite the reverse is true. The Association members bring their needs to the attention of research people and a comprehensive picture is exchanged of research potentialities and difficulties. The Association is able to make a major contribution by bringing to bear financial and operational assistance. By operational assistance is meant the arrangement for semi-commercial tests. Most important, purely commercial considerations are not allowed to interfere with the development of a sound research programme.

My observation of the Israeli scene this last few months has led me to believe that a similar association is needed there. Merchandising organisations in themselves find great difficulty in developing a good research programme. The difficulty is easily recognised as inevitable; the merchandising group have a day-to-day responsibility which can never be relegated to a secondary position, much less ignored. In the specific Israeli situation, the ordinary merchandising obstacles to research were multiplied by problems of wood purchases, exchange, political position and of individual position. I mention these problems with reluctance because I shall always be grateful to the Citrus Board for bringing me to Israel and affording me such a great opportunity.

Nevertheless, the Board can hardly undertake, at once, two objectives so remote to each other as day-to-day merchandising and research.

The problem of the merchandising organisation can perhaps be best brought out by contrasting its position with that of the grower and his relationship to research organisation. A grower faced with a new development can view it with a most worthwhile and encouraging viewpoint. His own single interest is at stake and assuming an intelligent open mind one can count on a proper analysis. The complication of fixed capital investments are not ignored but still are not allowed to obscure the ultimate advantage. The decision, if correct, is to the advantage of the individual concerned.

A large merchandising organisation, unfortunately has no such simple position. Unless an individual as a matter of personal prestige ties himself to an idea he is not apt to gain directly from it. On the other hand, specific job and investment positions may be put in hazard by any new development and at best, it will be regarded as suspect. If competition with other similar organisations dominated the situation; in self-defence, the organisation might have to act but without such competition only the efficacy of idealism remains and sadly enough such motivation is usually weak.

An illustration of the difficulties encountered by a merchandising concern is found in the recent shipments. A plan of real merit, albeit rather large, was worked out and approved by all concerned. In the exigencies of marketing a crop the plan was forgotten; such elementary facts as controls were ignored. No one can be criticized. The merchandisers concerned had more important things to do than worry about controls. They should not be expected to do such things. But neither should people in research have been asked to help market a crop, whatsoever the exigency that may or may not have existed.

This distinction in responsibility does not mean they cannot work together; but when they must work together the division of work and authority must be clear. In California, I am convinced it works much better under the leadership of such a group as is found in the Research Association.

Israel has the fundamental elements of first-class research work. The ability of its people was demonstrated with the development of Diphenyl and of the double treatment process in handling Citrus Fruits. My suggestion is simply that the individuals who are actively concerned with such work should, as individuals, be put into a position where they can promote and otherwise aid the research work needed. Israel has the people, Dr. Lattaur and Dr. Nadle and their staff; Mr. M.H. Sachs, Mr. Z. Pintow, Mr. Wasserman, Mr. E. Danen, Mr. M.S. Gilutz, Mr. Gadel, Dr. Ophen and his staff, Mr. Goor, Mr. J. Jacobsen, Mr. Gesundheit, Mr. Shoham, and others who are able and willing to help; and with their combined prestige will work out these problems.

I am sure everyone has long since recognised the ability of these people. I merely suggest they be so organised that they can be objective and effective in their wish to aid marketing research.

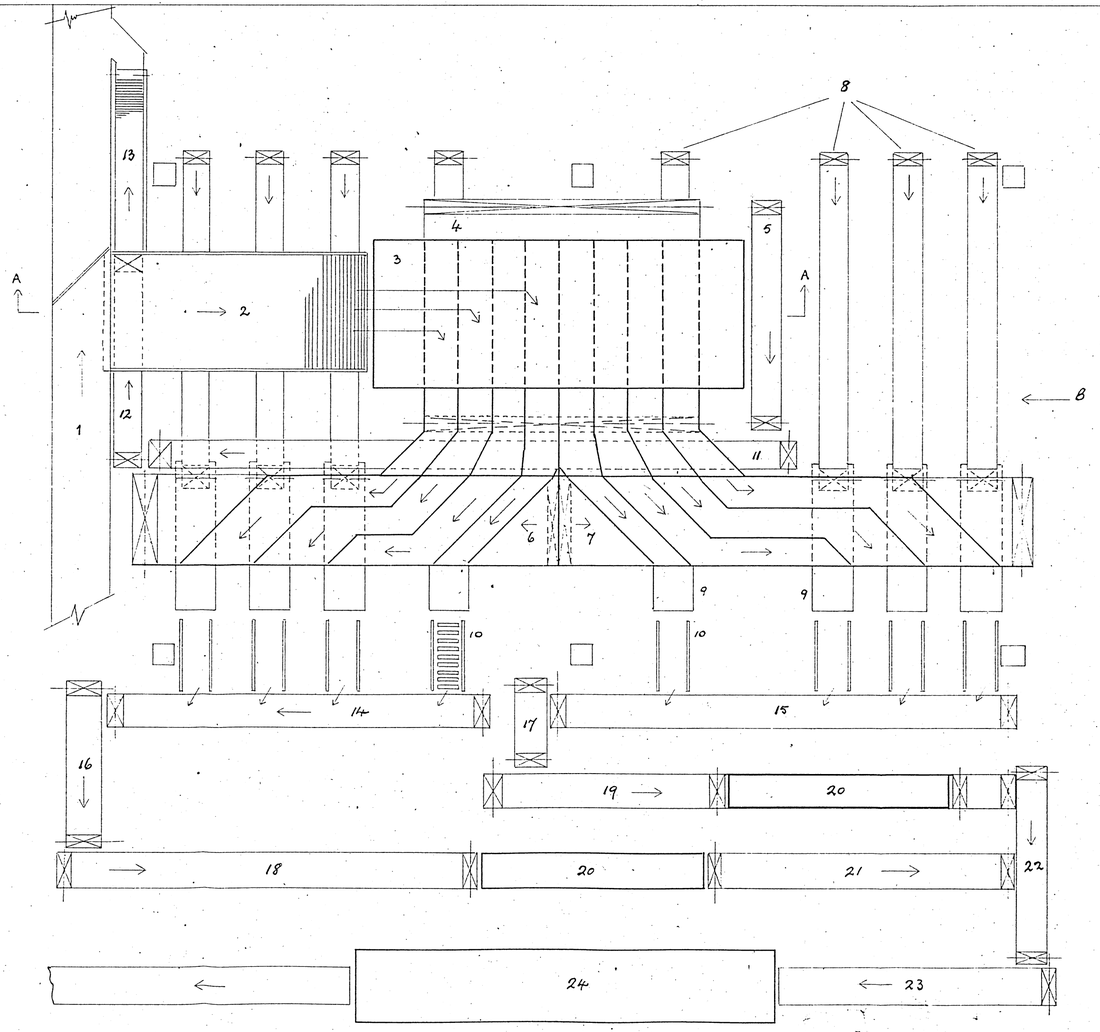
AGENDA

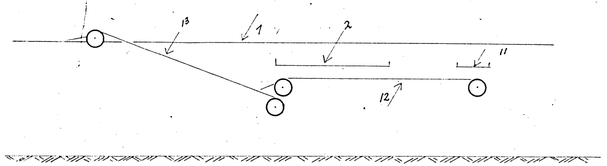
1. Feeding Conveyor
2. Roller Elevator
3. Drop Roll Sizer
4,5. Conveyors for sized Fruit
6,7. Distribution Conveyors
8. Box Folding Stations.
9. Automatic Volume-Fill Stations
10. Automatic Inner Section
11,12. Diversion Conveyors
13. Diverted Fruit Roller Elevator
14,15. Packed Cartons Conveyor
16,17. Turning Belt
18,19. Conveyor Belt (Special)
20. Shaker
21,22,23. Conveyors
24. Sealing Machine.

VOLUME-FILL PLANT LAYOUT

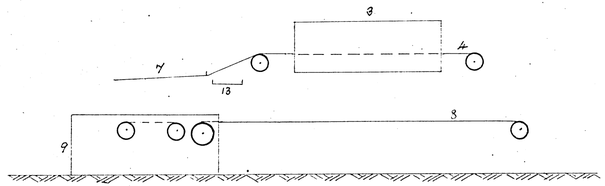
by

PROF. ROY J. SMITH

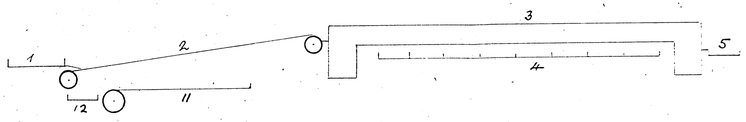




VIEW 'A'



VIEW 'B'



SECTION A-A