Table Grape Packaging Studies 1994
A Draft Proposal for Review by the Packaging Steering Committee
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Based on our findings during 1993, we propose to evaluate during 1994 whole-pallet units composed of the following box footprints (outside dimensions) and construction materials:

Corrugated, 12 x 20 and 14 x 17.5
Wood, 12 x 20 and 14 x 17.5
EPS foam, 16 x 20 or 12 x 20, with the selection of the final foam footprint to be used in most of these tests being arrived at following the San Joaquin Valley Flame Seedless experimentation.

All boxes will be 5.5 inches deep (inside dimension), except the 12 x 20 foam box, which will have an internal depth of about 7.1 inches. Although the suspected relation between BRIX and pack density will have to be developed in detail in simultaneous experimentation, we believe that these boxes should be packed with the following weights of grapes, depending on soluble solids content:

	BRIX	
	Under 17	Over 17
Plain-packed fruit		
Corrugated, 12 x 20 and 14 x 17.5	20 pounds	22 pounds
Wood, 12 x 20 and 14 x 17.5	20 pounds	22 pounds
EPS foam, 16 x 20 or 12 x 20	20 pounds	22 pounds
Bagged or tissue-wrapped fruit		
Corrugated, 12 x 20 and 14 x 17.5	18 pounds	20 pounds
Wood, 12 x 20 and 14 x 17.5	18 pounds	20 pounds
EPS foam, 16 x 20 or 12 x 20	18 pounds	20 pounds

Note a potentially confusing issue - we are proposing that the old distinction between the Coachella Valley vs the San Joaquin Valley in required weights of pack (22 vs 23 pounds) is artificial and unreasonable and should be replaced with a distinction between less-than-17-BRIX fruit vs more-than-17-BRIX fruit (20 vs 22 pounds). Note also that we are proposing replacing the old 23-pound standard for mature fruit with a 22-pound standard, based on our finding that packing the proposed boxes level-

full or even 10% heavier than level-full will not accomodate 23 pounds of fruit under most situations, but will accomodate 22 pounds of fruit.

The major element of our 1994 experimentation involves packing the new specified weights of plain-pack, bagged, and tissue-wrapped grapes (outlined above for 12x20 and 16x20 footprints) into 5.5-inch-deep boxes of wood-end, corrugated, or foam construction (exception is the 7.1-inch depth of 12 x 20 foam) boxes. For comparison to the present, most commonly used styles of packing, the standard 5.5-inch deep 14x17.5-inch wood-end or corrugated boxes will be plain-packed with 23 pounds in the San Joaquin Valley or 22 pounds in the Coachella Valley, or packed with bagged or wrapped fruit at 21 pounds in the San Joaquin Valley or 20 pounds in the Coachella Valley. After either storing the packed, palletized grapes for 6 weeks and/or not storing, depending on the cultivar and the conditions of the test, they will be shipped to San Francisco (Walnut Creek), New York, London, and/or Hong Kong.

Sub-experiments will be piggy-backed on this major testing scheme, to allow the testing of inner packaging (plain-pack vs poly bags vs wrapped fruit). Any one experimental pallet will be composed entirely of boxes of a given construction material and foot print. However, the layers of boxes within each pallet can be made up of the different types of inner packaging to be tested. Thus, there might be a layer of bagged fruit followed by a layer of tissue-wrapped fruit, followed by a layer of plain-packed fruit. Having these different inner packagings in layers will allow the comparison of the efficiency of the different packagings with regard to precooling, initial fumigation, storage-room fumigation, and moisture loss. Although this horizontal alignment of the inner packagings is appropriate for their testing during cold-storage intake and holding, a vertical alignment is most appropriate for testing during transportation. This is because boxes in vertical columns in pallets operate together as units during transport vibration, with the vibration often being amplified vertically within the columns, depending on box construction materials and other factors. Therefore, before each transport test, the pallets will be restacked and boxes with similar inner packagings that were previously aligned in horizontal layers will be realigned into vertical columns.

After transport to the distant destination, each box in the pallets will be inspected to determine the quality and condition of the grapes, as affected by box construction materials, footprints, and inner packaging.

A list of the proposed 1994 whole-pallet box tests follows:

Coachella Valley
Perlette pack about June 1
Pack into: Corrugated 12x20, wood 12x20 (20 pounds plain, 18 pounds bags)
Corrugated 14x17.5 wood 14x17.5 (22 pounds plain, 20 pounds bags)
For each of the four box styles, pack 2 pallets to be shipped to Walnut Creek and 2 pallets to be shipped to New York. Also pack 2 pallets of 12 x 20 corrugated only, to be shipped to Rotterdam. For comparison, we will include in the Rotterdam shipment one "standard" pallet using a box style presently being shipped to London by the same collaborating shipper. This gives a total of 19 pallets.

Coachella Valley
Thompson Seedless pack about July 5-10
Pack into: Corrugated 12x20, wood 12x20 (20 pounds plain, 18 pounds bags)
Corrugated 14x17.5, wood 14x17.5 (22 pounds plain, 20 pounds bags).
For each of the four box styles, pack 2 pallets to be shipped to Walnut Creek and 2 pallets to be shipped to New York. This gives 16 pallets.

San Joaquin Valley
Flame Seedless pack about August 20
Pack into: Corrugated 12x20, wood 12x20 (22 pounds plain, 20 pounds bags)
Corrugated 14x17.5, wood 14x17.5 (23 pounds plain, 21 pounds bags).
Foam 16x20, foam 12x20 (22 pounds plain, 20 pounds bags).
For each of the six box styles, pack 2 pallets to be shipped to Walnut Creek and 2 pallets to be shipped to New York (shipping within one week of packing). This gives 24 pallets. An additional 2 pallets of each type will be sent to New York only on about October 1 after being stored for 6 weeks. This gives an additional 12 pallets.

San Joaquin Valley
Ruby Seedless pack about September 15
Pack into: Corrugated 12x20, wood 12x20 (22 pounds plain, 20 pounds bags)
Corrugated 14x17.5, wood 14x17.5 (23 pounds plain, 21 pounds bags)
Foam (either 16x20 or 12x20, depending on the results from the San Joaquin Valley Flame Seedless test) (22 pounds plain, 20 pounds bags). For each of the five box styles, pack 2 pallets to be shipped to Walnut Creek and 2 pallets to be shipped to New York (shipping within one week of packing). This gives 20

pallets. An additional 2 pallets of each type will be sent to New York only, on about November 1, after being stored for 6 weeks. This gives an additional 10 pallets.

San Joaquin Valley
Thompson Seedless, fully mature pack about August 25
Pack into: Corrugated 12x20, wood 12x20 (22 pounds plain, 20 pounds bags)
Corrugated 14x17.5, wood 14x17.5 (23 pounds plain, 21 pounds bags)
Foam 16x20 or 12x20 (22 pounds plain, 20 pounds bags)
For each of the five box styles, pack 2 pallets to be shipped to Walnut Creek and 2 pallets to be shipped to New York. This gives 20 pallets to be shipped within one week of packing. Also, for each of the five pallet styles, store for 6 weeks, until about October 10, and then ship to New York only. (Gives an additional 10 pallets).

San Joaquin Valley
Red Globe pack September 15
Pack into: Corrugated 12x20, wood 12x20 (22 pounds plain, 20 pounds bags)
Corrugated 14x17.5, wood 14x17.5 (23 pounds plain, 21 pounds bags)
Foam 16x20 or 12x20 (22 pounds plain, 20 pounds bags)
For each of the five box styles, pack 2 pallets to be shipped to Walnut Creek and 2 pallets to be shipped to New York. This gives 20 pallets to be shipped within one week of packing. Also, for each of the five pallet styles, store for 6 weeks and then ship to New York only. (Gives an additional 10 pallets).

The breakdown of numbers of pallets and numbers of each style of box that will be used in this experimentation is:

	No. pallets	Boxes/pallet	Total boxes
Corrugated 12x20x5.5	35	88	3080
Wood 12x20x5.5	32	88	2816
Corrugated 14x17.5x5.5	32	66	2112
Wood 14x17.5x5.5	32	66	2112
Foam 12x20x7.1 or16x20x5.5	30	66 or 88	2310
Totals	161		12430

At $3.00 per box for the packed grapes, the contents of these 12,430 boxes will cost $37,290.

At an average cost of about $1.30 each for the boxes, these 12,430 boxes would cost $16,159. We hope to have the boxes contributed by collaborating box manufacturers.

Shipping cost for 58 pallets to Walnut Creek @ 0.75/box =	$3350
for 100 pallets to New York @ 2.25/box =	17325
for 3 pallets to Rotterdam @ 5.00/box =	1155
Total shipping costs	21830

A side study of great importance is to pin down further the relation between cultivar, sugar level, and density of packing for both plain-packed and bagged grapes. This will determine the depth of box that is needed for each cultivar/brix level/geographic area combination. For each cultivar in the Coachella and San Joaquin Valleys, we will visit many picking operations and will determine the average brix as well as the number of cubic inches needed to accomodate given weights of grapes (determined by experimental packing known weights of grapes into ten volume-calibrated boxes at each test location). Following this test, we will have much more accurate information regarding the volume of box that is needed to accomodate a given weight of grapes for each cultivar, taking into account the different levels of sugar that might be encountered.

Another very important side study is associated with the damage that occurs in transit, especially through the vibrations that are transmitted through the bed of the trailer to the pallets of transported grapes. Our team of engineers will follow shipments of grapes cross-country, wiring boxes in many of the shipments to sensors and recorders that will indicate the nature of the vibrations and the boxes in which they are most pronounced. These data will be compared with extensive studies that will be conducted on vibrating columns of boxes of grapes at the Del Monte Testing Facility in Walnut Creek. Following some crosscountry truck trips, the whole load will be assessed to find the areas in the trailer where damage occurs and the extent of the damage that might be expected.

Budget:

Purchase of grapes	37290
Purchase of boxes	(16159*)
Experimental shipping of grapes	21830
H. Shorey salary, 4 months	32000
H. Shorey benefits, 4 months	9000
Transportation vibration testing - rental of Del Monte lab	4000
Travel, 12 person-trips to Walnut Creek plus 2x8days per diem	2800
Travel, 10 person trips to New York plus 3x10 days per diem	8000
Travel, local, for organizing and monitoring all pickings, packings, fumigations, shippings - 15,000 miles local travel plus 30 days per diem	6500
Labor, to supervise picking, packing, cooling, fumigating	12000
Labor for transit tests	5000
Equipment for transit tests	5000
Total cost of the research	139,420

(* We hope to have these expenses met by collaborating shippers and box manufacturers)