X Future Trends in Packinghouse Handling

The fresh fruit segment of the Florida citrus industry has undergone numerous changes in the past century; indeed, its history has been one of continual innovation in nearly every respect. Today it is viable though beset on every hand by increasing competition from other fruits and various citrus products, continually increasing regulation, growing awareness of consumers for better quality, and economic pressures from steadily rising costs. It is clear that packinghouse handling must become more efficient if the fresh fruit segment is to prosper in the future.

Florida, like other warm humid areas, is at a distinct disadvantage with respect to producing fruit with bright color and high external quality which must compete in fresh fruit markets with those from drier cooler areas. Nevertheless, Florida can produce fruit of superb internal quality in terms of high juice content, sweetness and aroma. It can also grow well a great many different kinds of fruit, such as 'Temple', tangerines, tangelos and various hybrids, which are strictly high quality, high mark-up specialty products. Grierson has pointed out a number of times in the past Florida really has 2 separate markets, tonnage items like oranges and grapefruit, the bulk of which are processed with only those having high external quality shipped fresh, and specialty fruits whose primary outlet is fresh shipment.

A. Packout

Historically, packinghouses have largely been operated as entities separate and distinct from the other segments, growing, harvesting and processing, which with packing and selling fresh fruit make up the industry as a whole. Any or all of these 4 operations may be under common ownership or management but they are typically run as separate businesses. Each seeks to minimize its own costs, whether or not at the expense of the other operations. The concept of maximizing net returns per acre (hectare), predominant in most agricultural operations, has, in consequence,

been largely ignored. Vertical integration of the industry in the true sense is long overdue

Many growers are concerned exclusively with on-tree prices for their fruit, with little or no interest in the subsequent stages of handling. Many of the present production practices are decidedly detrimental to fruit quality whether for fresh or cannery use, the primary emphasis being on yield. Principles outlined in Grierson's studies on the effect of packout on grower profits (Fig. 44) 20 years ago are even more pertinent today (Grierson, 1957; Grierson and Oberbacher, 1958). Several of the principal grade-lowering defects, such as green color, rust mite and melanose listed in Table 23 (Grierson and Oberbacher, 1958), are controllable under good grove management and certainly some form of windbreak would reduce the incidence of windscars.

There is no question the present quality of picking must be raised, whether through suitable incentives to pickers or continued improvement of mechanized harvesting. The feasibility of the latter for oranges is dependent upon timely application of a preharvest fungicide, reasonable picking crew discipline, and transportation to the packinghouse with minimum delay.

B. Inventory-to-Inventory Packing

Inventory-to-inventory packing has been standard practice in California and Arizona packinghouses for many years, as pointed out in the section on Refrigeration in Chapter VI. This is a logical approach for an efficient layout in a Florida packinghouse. The diagram in Fig. 45 represents an orange fresh fruit packinghouse fully integrated with a cannery (Grierson and Wardowski, 1975). This design differs from the conventional packing-house in the separation of various stages, working hours being suited to the degree of mechanization, availability of equipment and personnel, etc., for each stage, rather than running the whole operation as dictated by hourly fresh fruit sales.

Stages 1-4 would run hours dictated solely by efficient use of harvesting personnel and equipment. Fruit could be transported in side unloading bulk semi-trailers rather than pallet boxes, in which case these

would go into cloth-baffle bulk bins upon arrival at the packinghouse. Fruit would be run through stages 5 to 8 during the day, with one or 2 operators working overtime if the bins were not filled or all of the fruit had not been dumped.

Stages 8-14 would run continuously around the clock. Continuous operation of electronic sorting equipment could handle high volumes of fruit with a few machines, of 2 types, color sorters and grade-lowering blemish sorters, in tandem. Fruit would then be sized, accumulated by sizes in cloth-baffle bins and cooled to 50°F (10°C) with high humidity maintained. Fruit needing degreening would be color sorted and returned to holding bins modified for that purpose.

Stages 15-21 would be daytime operations running continuously with a minimum crew. Each piece of equipment would run at full volume, with palletized fruit being accumulated in a cold room. Sales would be made from an inventory of packed refrigerated fruit. (Note that eliminations go direct to the cannery with no postharvest fungicides, color-add or wax applied.)

There are several possible variations of the layout in Fig. 45 including total integration with the cannery and physical separation of the packinghouse and cannery. Both of these and other configurations would, however, require modification of present practices. The best overal solution is first for the grower to modify his practices to produce the very best fruit possible and second to make effective use of electronic sorting, fully automated packing and palletizing, electronic inventory control, etc. A third factor, which hopefully will be resolved as conversion to the metric system is completed, is the standardization of containers, with elimination of the outmoded standard box.

C. Consumer Packaging of Citrus Fruit (Grierson, 1969)

The following comprises excerpts from a paper in which Grierson enunciated 10 principles to guide future citrus packaging research but which could serve as a basis for evaluation of packaging problems for fruits and vegetables generally (students are urged to read the entire article in First International Citrus Symposium, Riverside, California,

March 16-26, 1968):

Principle 1. Expect a beneficial response to so-called "breathing films" only from those types of produce known to have a clearly defined positive response to controlled atmospheres. (Citrus fruit are certainly not in this group.)

Principle 2. Decide which is the greater hazard, desiccation or decay. (Citrus fruit are definitely in the latter group, for which ventilation to control excessive build-up of humidity is far more important than protection against desiccation.)

Principle 3. Industry customs and trade regulations must be considered in setting up experiments (e.g., Florida laws stipulate shipment of consumer bags in master cartons, thus the combination has to be considered a single entity in evaluation studies directly applicable to commercial conditions).

Principle 4. Package evaluation studies must simulate transit and marketing conditions as closely as possible. (Tests under static conditions can be most misleading, e.g., no significance in decay losses was found when comparing oranges in mesh bags with 5 lb (2.27 kg) poly bags with 16-1/4 inch (=6.4 mm) holes.)

Principle 5. Humidity must be considered in terms of specific humidity gradient between the package and its environment, rather than in terms of relative humidity within the package only. (Movement of water vapor can often be against the apparent gradient as expressed in terms of relative humidity.)

Principle 6. Beware of apparent lack of significant differences when decay levels are low. "Strong crops" will withstand considerable abuse with little effect on decay levels. "Weak crops" are extremely sensitive to minor differences in handling methods. Studies are suspect unless decay in the control is high enough to indicate a weak crop with a high decay potential.

Principle 7. Where possible, consumer packaging studies with citrus fruits should include the entire postharvest experience of the fruit.

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(Florida citrus fruits are particularly sensitive to the effect of delays between picking and packing and conditions during this period. Decay was 3.8% after 2 weeks holding at 70°F (21°C) when 'Valencia' oranges were washed, waxed and packed in cartons immediately, 12.5% after holding 48 hours on the packinghouse floor before running and 47.5% after 22 hours on a truck bed and 22 hours in shade of a tree before running.)

Principle 8. The financial impact of decay increases with the number of fruit in each consumer package. (W.G. maintains that it is the % bags with 1 or more rots that is important rather than the overall % decay, Fig. 46).

Principle 9. The decay hazard must be evaluated, not in terms of consistency of differences from a given standard, but in terms of the risk of encountering occasional disaster. (Reliance only on routine statistical methods, such as analysis of variance, can be very misleading. For example, decay averaged 6.6 times higher in poly (9.9%) than in mesh bags (1.5%) and was 10 times higher for the 2 weakest pickings of 'Pineapple' oranges held 6 days at 60°F (15.5°C) and 4 days at 70°F (21°C), yet differences between losses in the 2 containers was not statistically significant!)

Principle 10. For mass production products, such as citrus fruit, packaging methods must be adaptable to ultimate automation. (Packaging research for citrus has narrowed to a matter of protecting the keeping quality of fruit merchandised in consumer packages selected for their economy, sales appeal, and suitability to automated handling methods.)

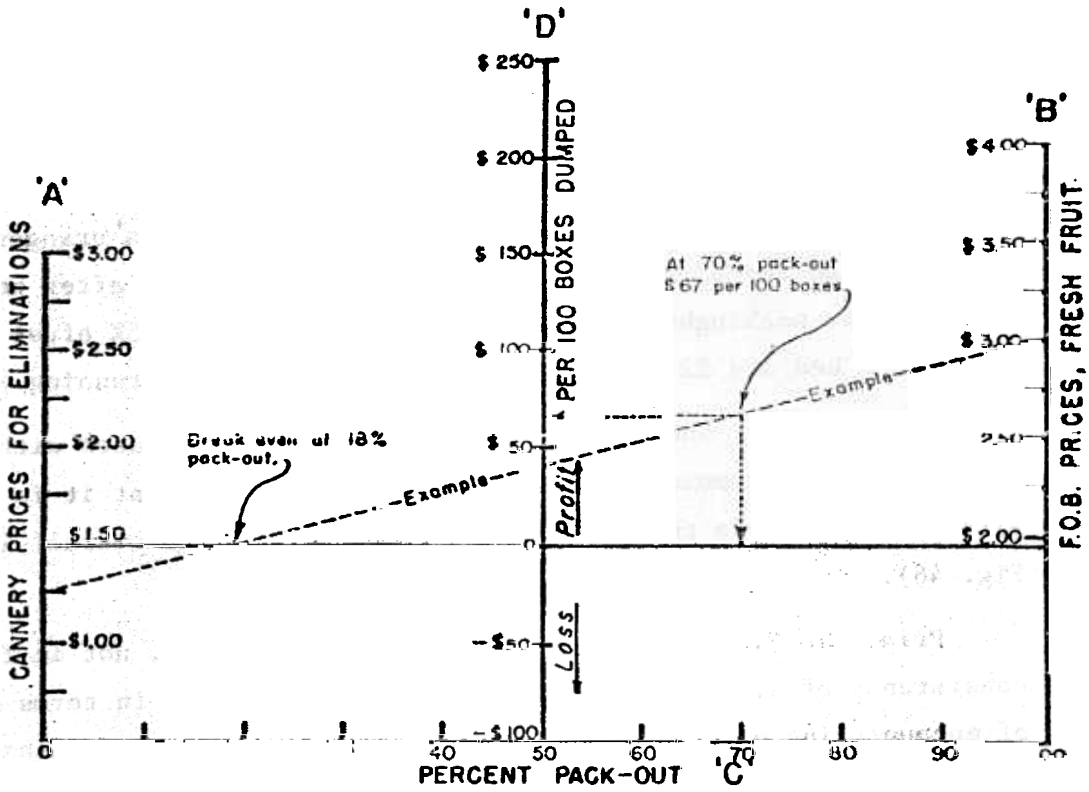

Figure 44. Nomograph for calculating profit or loss according to percent packout and prices of fresh fruit and eliminations (Grierson, 1957.)

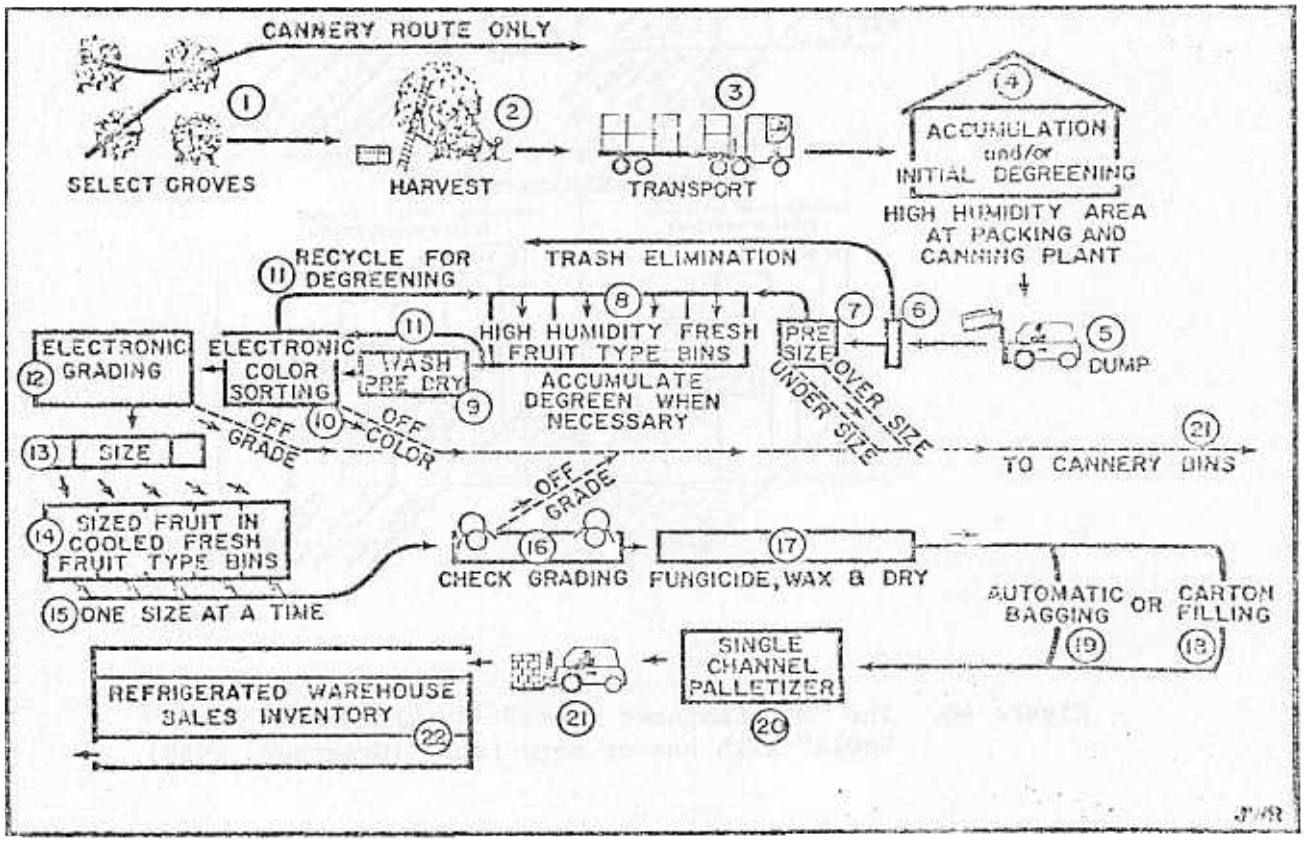

Figure 45. Orange fresh fruit packinghouse fully integrated with a cannery operation. (Grierson, 1977.)

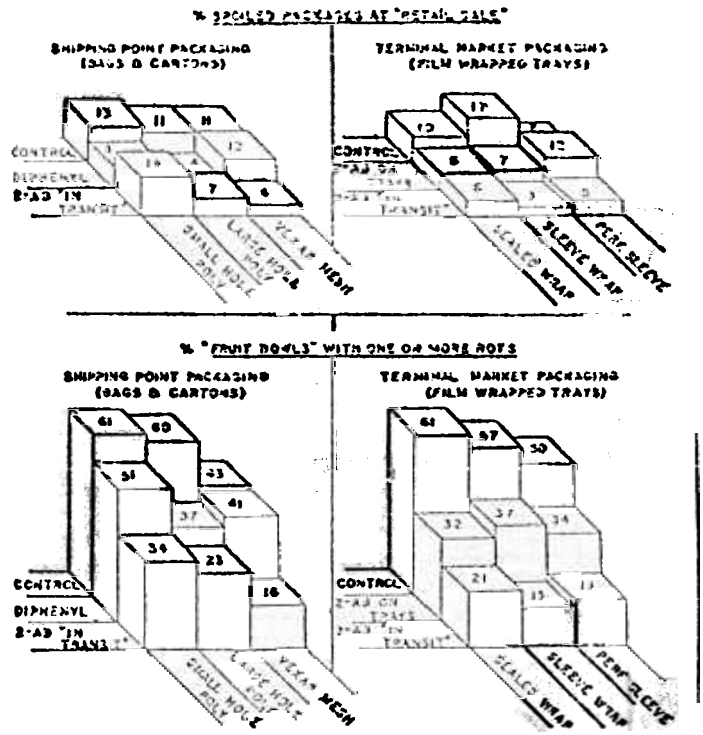

Figure 46. The "Mad Customer Index"--packages and "fruit bowls" with one or more rots (Grierson, 1969)

Table 23. Principal grade-lowering defects among samples of grapefruit and orange varieties, 1958-59 season (Grierson and Oberbacher, 1959).

Blemish	Grapefruit				Oranges		
	Marsh	Duncan	Ruby Red	Pink	Hamlin	Pinespple	Valencia
No. of Samples	88	47	5	45	4	51	123
Green color	8	6	7	19	14	9	20
Windscar	33	37	29	31	21	44	45
Rust mite	8	8	12	7	10	10	10
Melanose	25	30	26	14	31	14	4
Scale	7	4	10	8	17	9	5
Plugged	1	2	4	3	4	7	3
Off-size[a]	2	1	1	1	0	b	3
Mechanical injury	1	2	1	1	2	1	b
Texture	b	b	0	b	0	2	1
Off-shape	5	3	3	5	b	b	4
Creasing	0	0	0	0	0	2	b
Microspeck	4	1	2	4	0	b	b
Peel injury	1	1	0	2	0	b	b
Miscellany	4	5	5	5	1	1	3
Stem-end russet	1	0	0	0	0	0	0
Percent Pack-out Range	40-79	32-77	50-79	49-71	c	51-76	41-89
Percent Pack-out Average	66	58	80	70	c	68	72

[a] This figure would be considerably higher but for the common use of pre-sizers.

[b] Less than one percent.

[c] No pack-out data obtained for Hamlins.

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Selected References

Grierson, W.

The effect of pack-out on grower profits. Proc. Fla. State Hort. Soc. 70:21-28.

1959. Grierson, W. and M. F. Oberbacher.

Pack-out as affecting profits of citrus packinghouses with particular reference to fruit color. Proc. Fla. State Hort. Soc. 72:254-258.

Grierson, W.

Consumer packaging of citrus fruits. Proc. First Int. Citrus Sympos. III:1389-1401. (Also: Produce Packaging Mkting Assn. Yearbk. 1968. 10p).

Grierson, W.

Quality of produce as influenced by prestorage treatment and packaging. Int. Refrig. Inst. Commission C-2:1-22 (Jerusalem, Sept. 9, 1973).

1973. Veldman, L. G., et al.

Symposium--The agricultural labor situation in Florida. Proc. Fla. State Hort. Soc. 86:205-229.

Covey, C. D.

Handbook of regulations affecting Florida farm employers and employees. Fla. Coop. Extens. Serv. Cir. 411. 22p.

Grierson, W. and W. F. Wardowski.

Development of mechanization programs for harvesting and handling citrus. Proc. First Int. Citrus Congr. (Murcia & Valencia, Spain) 3:633-639

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1977. Grierson, W. and W. F. Wardowski.
Packinghouse procedures relating to citrus processing. Chap. 2, p. 128-140. In Citrus science and technology: Vol. 2. Fruit production, processing practices, derived products, and personnel management. AVI Publishing Co. Westport, Conn.

(1978. Myers, L. and W. Grierson.
World citrus production and trade: Current situation and future outlook. Proc. Int. Soc. Citriculture ___. (in press.)