FROZEN CONCENTRATED ORANGE JUICE— DEVELOPMENT AND SIGNIFICANCE

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Florida production of frozen concentrated orange juice in the 1945-46 season was 226,000 gallons, utilizing about 200,000 boxes of oranges out of a crop of 49.8 million boxes. In the 1961-62 season just over, more than 116 million gallons of frozen concentrated orange juice was produced from 73.7 million boxes of the 114 million box Florida orange crop. Thus in the short span of sixteen years, production of frozen concentrated orange juice has increased by a factor of 514, and the utilization of oranges for this purpose in the past season was 48% greater than the total Florida orange production in 1945-46. Put in another way, Florida now produces over 98% of the frozen concentrated orange juice in the United States, and utilizes almost 65% of its orange crop for this purpose. Many factors contributed to this growth. Among them were the quality and convenience of the product, the concurrent expansion of the frozen food industry, the supply of venture capital in the years succeeding World War II, advertising and promotion, and regulations to ensure quality.

One of us reported to the Society in 1945 (1) on the results of the early experimental work on frozen concentrated citrus juices, and predicted a favorable reception for the product. In 1949, when production had risen to 10 million gallons, Wenzel, Atkins and Moore (2) presented a further paper to this Society which reviewed technical developments to that time, and discussed the 'state of the art' as it was then practiced. It is interesting to note that these authors also predicted in substance the now uniform practice of buying oranges on a 'pounds-solids' basis for concentrate usage.

Since 1949 a host of new problems have been met and solved by the industry, resulting in the publication of 58 papers in the pages of these Proceedings alone. These were problems associated with the growing pains of an industry (and also, to a certain extent, with the effects of certain sub-normal temperatures). More efficient evaporators were designed and installed. Microbiological contamination of the product was examined and re-examined, and methods of sanitation were constantly improved. With increased sales of the product, temperature abuses in the channels of distribution resulted in more and more complaints concerning gelation and clarification. Heating methods were devised to inactivate the pectic enzymes, and correct this defect in physical stability. At the same time surveys of temperature conditions all along the marketing chain were carried out, and strenuous efforts were made to correct deficiencies. Many experiments were conducted on the response of frozen concentrates to storage at different temperatures for varying lengths of time.

New, highly efficient juice extraction equipment producing a greater yield of orange solids also appeared on the scene. The juices obtained from this equipment had to be evaluated with further changes in processing techniques resulting. It is interesting to note here that this new extraction equipment was a major factor in raising the yield of 42° Brix frozen concentrated orange juice per box of oranges from an average of 1.21 gallons for the four years prior to 1949 to an average of 1.53 gallons for the most recent four seasons. This 26% increase in yield of orange solids had much the same effect as adding 26% more acreage to the groves producing fruit for concentrate usage.

A great deal of attention has been given to the effects of different concentrations of pectic enzyme and different levels of the various kinds of naturally occurring pectins in frozen concentrated orange juice. Their actions and interactions are still not fully understood.

Frozen concentrated orange juice was originally conceived as a product which would closely approximate the quality of fresh orange juice, and in a form that would make it available on a year 'round basis. In addition, it was felt that its convenience would appeal to many housewives. These factors undoubtedly contributed heavily to initial acceptance of this product and its early growth, and continued to play important roles throughout the period discussed.

However, a fundamental economic factor, often overlooked, soon made itself felt. It became apparent that frozen concentrated orange juice was the most economical way to transport the produce of the farm, oranges, to the consumer's table. Handling costs were cut all along the line. The U.S.D.A. (3) reported as recently as February, 1962, that oranges, as frozen concentrated orange juice, returned 49% of the consumer's purchase price to the farmer. This percentage may be compared to 30% for fresh oranges and 37% for oranges in the form of canned orange juice. In fact, oranges as frozen concentrated orange juice returned a greater percent of the consumer's dollar to the producer than any other item on the list of fruits and vegetables reported by the U.S.D.A. for this period (October-December 1961).

After World War II, the frozen food industry in the United States expanded rapidly, and frozen concentrated orange juice became a familiar item in the growing numbers of frozen food cabinets. It sold well, and since its quality was maintained, and its price was moderate, it soon became the leading seller.

Minimum quality standards for the product were adopted by the 1949 Legislature and became part of the Florida Citrus Code. These standards prescribed rather narrow limits under which the product could be packed, and prevented the confusion that might arise by two or more dilution ratios of the product being offered to the public. The Code also prohibited the use of any additives, even sugar, in the product. This prohibition of the use of sugar made certain that only fully mature oranges of the required ratio could be used, and unquestionably was a major factor in maintaining high quality. Over the years, the Florida Citrus Commission has passed several regulations, all designed to maintain and improve the quality of frozen concentrated orange juice.

The significance of frozen concentrated orange juice has been, and is, manyfold. It has been felt by grower, processor, can companies, transportation and warehousing concerns, the wholesaler, retailer and consumer.

The consumer has been presented with a readily available, high quality, nutritious product at a reasonable price. She has accepted the product and approximately 30% of the United States families serve it at least once a month. It has enabled Florida oranges to be sold in volume in many new marketing areas, and it is interesting to note that California, our traditional rival in marketing oranges, now is one of our best customers for frozen concentrated orange juice. In fact, Los Angeles is second only to New York City in sales of this product.

Since its inception, the processors have packed a total of 844 million gallons of frozen concentrated orange juice. Expressed as 6-ounce can equivalents this would amount to almost 18 billion cans. A large majority of this number of cans passed through wholesale and retail outlets, adding to their dollar volume and profit. In 1960, frozen concentrated orange juice accounted for almost 10% of all frozen food sales in the United States.

Warehousing, truck fleets and rail cars had to be built to accommodate this volume of product from Florida to its market destination, and the can manufacturing companies had to erect new plants in Florida to make the necessary cans.

It has meant the establishment of 33 processing facilities and their accessory operations in Florida. These plants employ thousands of personnel on a yearly basis.

It is used as a raw material in other food manufacturing processes. For example, it allows the operation of a powdered orange juice plant on a twelve month's basis, thus reducing overhead and size of equipment.

Finally, the grower has benefited from increased outlets for his fruit at prices which have been generally satisfactory. It has been estimated that the on-tree return to the grower for oranges utilized for frozen concentrated orange juice during the 16 years of its existence totals 1107 million dollars (4). This income has been partially responsible for the many thousands of acres of new orange groves which have led Florida to its predominant position in the citrus world. Last year our State grew 82% of the oranges produced in the United States.

It is hoped that the increasing use of frozen concentrated orange juice, either in its present form or as a higher density product, will be able to continue to absorb our constantly increasing production at favorable returns to the grower.

LITERATURE CITED

1. MacDowell, L. G. The Research Program of the Florida Citrus Commission. Proc. Fla. State Hort. Soc. 58: 95-97 (1945).
2. Wenzel, F. W., C. D. Atkins and E. L. Moore. Frozen Concentrated Orange Juice—Past, Present and Future. Proc. Fla. State Hort. Soc. 62: 179-183 (1949).
3. The Marketing and Transportation Situation, February, 1962. U. S. Department of Agriculture.
4. Doctor W. E. Black. Private Communication.