PROCESSING PROBLEMS IN THE FROZEN FOOD INDUSTRY[1]

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The frozen food industry, as we know it today, had its start only 30 years ago. That is when frozen foods first were offered for retail sale. Today, the retail value of frozen foods exceeds 2½ billion dollars annually. Today, the frozen food cabinet holds a great variety of foods including fruits, vegetables, seafood, poultry, meat, citrus concentrates, bakery goods, prepared food specialties, and pre-cooked foods. Fruits and vegetables were the first items to appear and are still the backbone of the frozen food business. The following will be confined mainly to those items.

Our industry came into being, and has enjoyed strong growth because it has been able to offer the consumer a wide variety of foods of high quality and great convenience at prices which are competitive with similar foods in other forms. Through the quick freezing process, we are able to preserve foods with the least possible alteration of the physical structure, nutritive value and flavor. This has not been done without solving many problems. In fact, it is now evident that the retailing of frozen foods was launched when the problem of enzyme control in frozen vegetables was solved about 33 years ago.

In these basic items, such as fruits, vegetables, and citrus the area of raw material has presented and continues to present major problems. To bring about quality as we know it today we had to breed and select strains of seed that produces crops capable of retaining a fresh-like quality through the freezing process. As an example of the magnitude of this work, I can report that at our Seabrook research farm, we test from 500 to 1000 new strains each year. Not every year do we find improved strains, but over a long period of time we have improved the inherent quality factors of our crops. This is the type of work that must continue as it is a basic source of progress.

In plants, as in animals and men, there is a continuous development of new diseases. Some of these, such as asparagus blight, pea wilt, and lima bean mildew, are devastating diseases which can practically wipe out the crop throughout the area of attack. Many of the minor diseases can be controlled by chemicals, but the serious diseases have been best controlled through genetics by breeding resistant varieties.

As any backyard gardener knows, insects are a constant threat to all crops. The processor's problems, however, are much more acute than are the backyard gardener's. We cannot discount the unsightliness of insect damage on our products simply because we grow them ourselves. We have the consumer to please, and above all to protect. We must produce products that are free from insect damage or infestation and at the same time are completely wholesome, which means they do not contain harmful residues of insecticides. This is a serious responsibility and not an easy problem to control. As you may well know, there have been hundreds of new insecticides developed during the past twelve years. Many of them have had a short term of effectiveness because insects develop resistant strains. This all adds up to a big and complicated job for the processor. He must select from the approved insecticides the effective one for his needs. He must determine how it can be used with regard to dosage and timing of application to get results and have a product free from harmful residues. About ten years ago we attacked this problem by installing a simple bioassay laboratory. We use the Drosophila, or fruit fly, as the test animal. The test procedure is quick and simple as compared to the chemical analytical techniques. The results are accurate to about 1 part per 10 million.

I believe the agricultural side of our business is the most complicated and interesting side. Of course, there have been many other problems and achievements in this field. By the use of climate data, we can control the flow of product into process by planting crops to meet a predetermined harvest date. We can determine when and how much irrigation to apply by measuring plant evapo-transpiration rates. It is a highly scientific business in that many of the physical and biological sciences are involved, yet, we still find conditions or problems which seem to respond best to the intuitive "green thumb" treatment of our highly experienced farmers.

The processing side of our business involves procedures which are more readily controlled. But rigid control throughout the process is necessary for quality results. Blanching, a key step in process, must be closely controlled as to time and temperature. Water blanching has been found to give better results with some products, while steam is better for others. Color and vitamin retention is improved by increasing the cooling rate following blanching. By reducing the

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cooling water temperature to 50°F and providing gentle agitation in the cooling tanks, we have increased color and Vitamin C retention by as much as 12%. Washing techniques using combinations of soaking, flooding, agitation or jet sprays have been developed for each product. In some cases detergents can be used. In all cases, great quantities of water must be used. This is a problem that is not yet solved from the economic point of view. This past year, we used about 10 gals. of water for each pound of product produced. When we produce up to a million pounds a day, you can see we create a real problem of waste water disposal without polluting the natural water shed of the area. We are fortunate in having near-by woodlands with soil and forest mat structure capable of soaking up over 1000 inches of water a year.

Scheduling the flow of prime maturity raw material through a freezing plant is a major economic problem to the processor. The production season for most crops is a relatively short time of from 4 to 10 weeks. Specialized equipment, representing a high capital investment, must be on hand to process each crop. Economics dictate that this equipment be scheduled for maximum use. Crop yields vary from year to year. These are some of the important factors of the scheduling problem. We have developed production schedules which give us uniform flow of product from day to day through use of planting schedules based on climate data. We have not been able to control variations in yield per acre. Though we have improved on this situation, we have much more to do. Hour to hour fluctuation in raw product deliveries have been effectively brought under control by the installation of hydro-coolers and cold storage. Hourly excesses are immediately cooled and held under refrigeration to be fed into process during slack hours.

As this is a meeting of sanitarians, it is only fair that I mention that we have problems in the field of sanitation too. While we know of no case of food-borne illness or food poisoning having been attributed to frozen fruits or vegetables, the processor agrees that the control of bacteria is a most important facet of processing. Large numbers of microorganisms are found on our raw products. Vegetables grown in or in contact with the soil may be seeded with fecal organisms, especially if grown in manured soil. After washing and blanching, however, the total count is reduced to a few hundred per gram. Unfortunately, we cannot pack or freeze our products directly following blanching. Final inspection and in some cases trimming must be done before packaging. This means exposure to conveyor belts and handling. Conveyor belts become soiled with juices and the bacteria are given a happy environment in which to multiply and contaminate the food product. Any handling of food exposes it to contamination by fecal organisms. Obviously, without good sanitation procedures, our finished products could very well carry higher counts than the raw product from which it came.

Our sanitation program includes:

1. Consideration of equipment design for ease of cleaning and self-cleaning features.
2. Cleanliness and sanitary habits of personnel.
3. Provision of adequate time, materials, and facilities for line clean-up and sanitizing.
4. Use of wash or rinse of product just prior to packing or freezing.
5. Application of heat or refrigeration to product at critical point in process.
6. The use of in-plant chlorination.
7. Prevention of delay in flow of product from line end to freezer.
8. Routine bacteria counts on product and equipment.

Some of our most difficult problems lie in the area of equipment design. We have purchased heat exchangers which were supposed to be of sanitary construction only to find they were bacteria generators. Many fillers must be re-worked in our shops to eliminate product "cling spots." Other pieces may have dead spots which will collect food particles. Yet, we are making good progress. Equipment suppliers are doing a better sanitary design job with each new model. The recent AFDOUS deliberations on these problems are sure to stimulate further improvements.