PROGRESS REPORTS ON RESEARCH BEING CONDUCTED AT THE UNIVERSITY OF CALIFORNIA AT DAVIS ON DRIED FRUITS

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Some of the projects have been completed and articles prepared for publication. Other projects more recently started can only be summarized as to the results obtained to date and to what the future plans are.

About one-half of the total raisin production goes to the baking industry and other commercial users. Since preparing raisins for use in the bakery involves time, expense, and equipment, this largely limits the use of raisins to the larger bakeries. It is hoped that the commercial production of a high-moisture raisin would increase the use of raisins by companies already using them, and also by many others which do not use them now because of the labor and time spent preparing them for use in their products.

The work conducted on the production of high moisture raisins has been concluded and the experimental results will appear in the Food Technology Journal to be issued in either June or July of this year. A brief summary of this work is as follows:

A procedure was developed for commercial rehydration of raisins to approximately 22% moisture by immersion in hot water. Increasing the rehydration liquid from 0-20% soluble solids content slowed moisture absorption by, and the leaching of soluble solids from, the raisins. Raisin weight gains were increased, however.

Raisins began to show excess moisture or "syrup" when rehydrated to approximately 21-22% moisture. Syruping increased with storage temperature and moisture content of the raisins. Mold was restricted primarily to raisins with moisture contents exceeding 24-25%.

The work conducted in cooperation with the California Raisin Advisory Board on investigations of grape dehydration during the 1959 and 1960 seasons has been reported in full detail to the Advisory Board. The purpose of this research was three-fold: first, to study the practicability of producing natural-type (sun-dried) raisins by artificial drying, retaining the bloom and color characteristics of sun-dried raisins; second, to investigate methods of reducing drying time on lye dipped raisins (Soda and Golden Bleach types) in standard dehydration tunnels (a shorter drying period would allow a reduction of capital investment cost per dry ton of fruit produced); and third, to develop cheaper dehydration methods and equipment. Again, the objective was to reduce the high capital investment cost per dried ton of dehydrated raisins.

While a natural-type raisin could be produced in a dehydrater, the dehydrater costs per ton would probably under the present conditions make such an operation impractical.

It was also found that the time required to dehydrate Soda or Golden Bleach type raisins could be reduced from 22-24 hours to 16 hours or less. The quality of the raisins produced was good, but the experiment showed that the present design of standard dehydraters is not adequate for this type of operation. The reduction in time was obtained primarily by a heavier degree of skin checking by lye followed by a high temperature parallel-flow dehydration for a short time and then finished in a regular counter-current dehydration tunnel.

In the development of cheaper dehydration methods and equipment, crop drying equipment such as has been developed for the drying of grains was tested. Production of natural-type raisins using this type of equipment was again successful and upon inspection it was decided they would meet federal marketing order requirements if delivered as sun-dried raisins. Cost of dehydration again makes grape dehydration by this method impractical at the present time.

Much of this work requires further investigation, incorporating the knowledge already gained and modifications of the equipment used.

Also, in cooperation with the California Raisin Advisory Board and the Fresno County Farm Advisor, studies were conducted to determine the effectiveness of various chemical compounds as inhibitors of mold during the drying conditions which might exist in times of unseasonable rains during the drying period. Results of the first-year work show several compounds have given promising results. Plans for the coming year include retesting of some of the more promising compounds as well as the testing of compounds not included in the first year's work.

Although there is considerable information available on the composition of Thompson seedless sun-dried raisins, there is very little information available for Golden Bleach, Muscat and Zante Currant types of raisins. Samples collected from raisin packers in the Fresno area have been analyzed for the acid content, protein, total sugar, potassium, sodium, calcium, magnesium, and iron contents. Additional analyses are planned for these samples, as well as the collection and analysis of samples to be collected from the 1961 crop year.

Two studies have been conducted dealing with dried figs. The first study is being made on some factors influencing color changes in dried figs and manufactured fig paste. Since color and its retention are important factors in commercial fig pastes, samples of pastes from figs of the 1958 crop and some of the 1957 crop were stored at various temperatures for varying lengths of time and under different packaging atmospheres to determine the color changes which took place under these conditions. It was found that the initial rate of browning at a constant temperature varies with the initial color and composition of the fig paste. Lightening of color of the fig paste by bleaching with hydrogen peroxide has only a temporary effect. It was also found that the rate of browning was increased with oxygen present in the package. The initial rate of browning at a temperature inducive to such changes is relatively rapid during the first few days of storage. After this initial period, the browning continues at a slower constant rate. No apparent improvement of the quality of fig paste was observed when harvesting procedures were varied in a field experiment. However, the results obtained in this study should be repeated during another crop year to ascertain the variation of weather conditions and its effect on the dried fig itself.

The second study concerning figs is a microbiological study of the flora associated with the fig wasp. Since the wasp carries the pollen necessary to set the Calimyrna type fig, the microbiological flora which it may introduce at the time of pollenation is important for an understanding of the spoilage problems of Calimyrna figs during maturation. An article dealing with the results of this study is to be published soon in the Journal of Insect Pathology.

Research dealing with prunes consists of one new project and the "following through" with several older projects. A continuation of the effects of mechanical harvesting on the fresh fruit and the quality of the resulting dried products was continued in the interior valleys where mechanical harvesting equipment, particularly frame catcher types, is being used for commercial harvest. The results obtained continued to show that injury to fruit harvested in this manner is less than that harvested by the conventional hand-picking operation. In addition, cooperative studies with farm

advisors of the Extension Service in prune-producing counties were initiated to put into practice the results obtained during studies under a contract relating prune maturity and harvesting practices to the quality of dried fruit. The articles which have been written from the experimental results obtained in the contract studies deal with dry bulk handling of prunes, the influence of harvesting procedures and storage on the quality of dried French prunes from the coastal region, as well as the physical and chemical changes which occur in these prunes during maturation, including changes in the internal and external color of French prunes with relation to maturity. The initial studies of mechanical harvesting on the quality of the prunes is included. In addition to these articles on the effect of maturity and harvesting on the quality of the dried fruit, additional articles are written on studies concerning the microbial spoilage of processed dried prunes and on the characteristics exhibited by the yeasts and molds isolated toward high sugar concentrations and relative humidity. It is the present plan to have all of these articles published in one journal (Hilgardia) so that the results of the entire study will be available in one reference. In addition to the cooperative projects with farm advisors which are planned to be continued, a new project is being set up in which fresh fruit evaluation versus dried fruit quality will be conducted with the objective in mind of ascertaining whether or not such an evaluation could be the basis for receiving fresh fruit from the grower, thus omitting the present practice of keeping lots separate after drying.

A recent study has been conducted on prunes to determine the compositional changes which take place in prunes during dehydration and during processing for the production of juice and concentrate. During the processes of dehydration and extraction, prunes are subjected to elevated temperatures for prolonged periods of time. The chemical changes which take place in the prune tissues during this time have not been adequately studied. The present study emphasizes the changes in chemical composition of the fresh fruit during dehydration and of the extracted juice of dried fruit.

The samples of fresh French variety prunes were collected from the University orchard at Davis, California, and were dried in experimental dehydraters under conditions simulating those of commercial practice. The dry bulk temperature did not exceed 165° F. Samples for analysis were taken from the fresh fruit when approximately one-third and two-thirds dehydrated and from the dried fruit (approximately 16% moisture). Juice was experimentally extracted from the resulting dried fruit by both diffusion and disintegration procedures. In addition to the experimental samples, commercially prepared juices and concentrates obtained from commercial sources were also analyzed.

Analyses were made to determine the amino acids present, the protein content, sugars and organic acids present, total acidity of the fruit and ash content. It is planned that additional samples will be collected and analyzed for composition variation and analyses for other components made.

A great deal more work needs to be done on these products so that the industry may have information available to it on the composition and the possible variation to be expected of the various components for the information of buyers of these products.

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