

# AGRICULTURAL EXPERIMENT STATION of The Alabama Polytechnic Institute, Auburn, Ala.

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## COMMERCIAL REACTIONS to ALAMALT -- A FULLY-COOKED SWEETPOTATO FLOUR 1/, 2/

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One of the prime needs of the South today is the development of market outlets for new crops and their products or by-products. The sweetpotato is a crop native to the area. During the past decade, considerable attention has been focused on the sweetpotato industry.

Beginning in 1941 and 1942, and continuing to date, commercial exports and shipments of sweetpotatoes have increased in importance. New and improved methods of processing sweetpotatoes through dehydration, canning, and manufacture of starches have been accelerated. During the same period, an increase in military demands for sweetpotatoes occurred. Despite all of these factors, however, the annual carry-over of sweetpotatoes during the past decade differed little from that of 20 to 30 years earlier.

Total annual sweetpotato production and consumption averaged about the same amount during the past decade as during the period 1909-19. Per capita consumption of sweetpotatoes, however, has failed to keep pace with increases in population. For the United States as a whole, sweetpotato consumption declined during the past three decades from 26 pounds per capita in 1919 to 14 pounds per capita in 1949.

Beginning in 1942, a research project at the Alabama Agricultural Experiment Station on development of new products from sweetpotatoes for food uses, placed major emphasis on the possibilities of developing new food products and/or new ingredients of food products that would require less sugar in manufacturing and that also would possess higher nutritional values than many food products and/or ingredients currently on the market. These efforts resulted in development of a number of different products derived

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2/ The research on which this report is based was made possible by funds provided by the Agricultural Research and Marketing Act of 1946. The Department of Agricultural Economics, Alabama Agricultural Experiment Station, assumed major responsibility for conducting the study under provisions of a cooperative agreement between the Alabama Agricultural Experiment Station and the Bureau of Agricultural Economics, United States Department of Agriculture.

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from sweetpotatoes, 3/

Among the more promising of the new food developments during that period was a product called ALAMALT 4/ -- a product made from sweetpotato puree. The product was not subjected to comprehensive consumer and/or commercial acceptance tests when first developed and, therefore, little was known of its potential market possibilities.

This is the fourth in a series of reports 5/ presenting results of nation-wide consumer and/or commercial acceptance tests of several new food products made from sweetpotatoes. This particular report deals with ALAMALT. It is concerned primarily with the over-all problem involved in measuring whether or not a product of this nature, made from sweetpotatoes, would be accepted and utilized by commercial food manufacturers, processors, and distributors. Results of this study will largely determine the extent to which additional research on the product will be undertaken. 6/

#### Description of ALAMALT

The ALAMALT used in the test was made wholly from cured sweetpotatoes. Sweetpotatoes were prepared by washing, trimming, baking, peeling, and pulping. This process resulted in a smooth, well-colored puree, free of fiber, having a moisture content of approximately 60 per cent. The puree was further processed immediately or was frozen and stored at 0° F. and used as needed. Further processing included loading the puree on metal trays by an extrusion operation, drying, and toasting to a moisture content of approximately 2.5 per cent. Drying and toasting was done in an oven at a temperature of 270° F., with air circulated at a velocity of 1,000 feet per minute.

3/ For a detailed discussion of the development of some of these new food products, see L. M. Ware. "Nature of Alayam Products." Sweet Potato Journal. December 1946.

4/ ALAMALT is a coined word devised to represent fully-cooked sweetpotato flour. It is one of a number of "Alayam" ("Ala" for Alabama and "yam" for sweetpotato) products. Both ALAMALT and Alayam were first used as brand names to apply to the specialty-food products developed by the sweetpotato food-research projects of the Alabama Agricultural Experiment Station during World War II. The words ALAMALT and Alayam are used in this report to distinguish the product tested and other Alayam products from all other types and kinds of similar products.

5/ Other reports in the series include: (1) Alabama Agricultural Experiment Station Bulletins No. 271, "Consumer Reactions to 'Alayam' Candy," May 1950; (2) No. 272, "Consumer Reactions to 'Alayam' Snacks," June 1950; and (3) No. 273, "Consumer Reactions to 'Alayam' Breakfast Food," June 1950.

6/ Concurrent with this study, technicians in the fields of production and manufacture have been working on the problems involved in development of continuous or semi-continuous processes to manufacture the product. All previous manufacturing, including manufacture of the sample product used in making the test, has been done on a pilot-plant basis at the Alabama Agricultural Experiment Station in Auburn.

The product was dried and toasted in the form of finned strips (approximately 3/8 of an inch in diameter), extending the full length of the trays on which the product was toasted. Strips were broken into odd lengths during the process of unloading from trays and preparing for packaging. Generally, individual pieces of the product ranged from 1 to 4 inches in length. The product was reduced to a flour by a grinding operation -- usually with a burr mill.

ALAMALT is quite different in its properties, uses, and method of preparation from sweetpotato flour prepared from dehydrated sweetpotatoes. 7/ Regular sweetpotato flour prepared from dehydrated sweetpotatoes is made by reducing the dehydrated product, usually the off-color grades, to a flour by use of a hammer mill. ALAMALT is prepared by baking the potato until fully cooked, peeling, pulping, extruding the pulp onto enamel trays, drying, toasting, and finally grinding the toasted product in a burr mill.

The final product is a light yellow flour, containing 97 to 98 per cent solids. When moistened, it turns a deep orange-brown color. On exposure to air it absorbs and holds moisture. The moisture-holding property makes it especially hygroscopic. When packaged in moisture-proof containers, the shelf-life of ALAMALT is exceptionally long. But when exposed to air, it absorbs moisture readily and soon cakes or becomes soggy.

After manufacturing, the product may be stored in bulk in sealed metal drums at common temperatures until ready for use. Samples used in this test were packaged in one-pint glass jars prior to shipment to the commercial and research organizations that cooperated in testing the product.

ALAMALT is a highly nutritious and concentrated food. It is especially high in sucrose and maltose sugars. Also, it is a good source of carotene, which supplies vitamin A. 8/

"ALAMALT has possibilities for a number of commercial uses. It may be used in a large number of bakery items, candies, ice cream, and drinks. As an ingredient in bakery items, it has been (used) in fruit cakes, layer cakes, southern brown bread, cookies, biscuits, muffins, icings, and pies.

"ALAMALT may replace a portion of the eggs, butter, and sugar in cakes.... The amount of the potato flour added to bakery products is not large. If, however, the bakery trade comes to accept sweetpotato flour as an ingredient...it would consume vast quantities. Each pound of the flour consumed would represent 5 to 6 pounds of cured potatoes, and it is of high importance to the grower, the shipper, and the manufacturer that off-grade potatoes make just as satisfactory a product as No. 1 potatoes, provided they are

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7/ See L. M. Ware, Hubert Harris, and Mildred S. Van deMark. "Commercial Uses for Fully-Cooked Sweet Potato Flour." Southern Food Processing. June-July 1947.

8/ Mildred S. Van deMark. "ALAMALT -- Its Properties and Uses." Alabama Agricultural Experiment Station Progress Report Series No. 23. December 1945.

sound and well cured." <sup>9/</sup>

"The sugar content of the product (ALAMALT) ranges from 38 to 42 per cent. The cost of the sugar contained in this product would make it much too high to compete at present (1946) with commercial sugar. Even at low sweetpotato prices, it is doubtful that the cost of sugar (not crystal sugar but the sugar value) from sweetpotatoes will ever be low enough to compete with commercial sugar.

"Claims for the product rest on the basis of superior quality, on the properties given to other products when the fully-cooked flour is used as an ingredient, and on the use that may be made of the process to combine highly nutritive products of low palatability with sweetpotatoes to give products of high palatability and high nutritive value." <sup>10/</sup>

### Objectives and Methods of Study

This study was designed to obtain a representative cross-section of the opinions, attitudes, reactions, and evaluations of ALAMALT from the nation's major commercial food processors, manufacturers, and distributors. The study was limited to this group because (1) most such firms have research facilities and personnel available for testing such products, and (2) the product is better adapted to institutional uses than to individual consumer uses. No attempt was made to have the product tested by individual consumers (households).

A group of 50 commercial organizations, located in all sections of the country, were selected and contacted in January 1950, with respect to their interests in testing ALAMALT. Approximately 90 per cent of this number replied to the inquiry. Of that number, about two-thirds were interested in testing the product; most of those in the remaining third indicated that they were not interested in the product. In this latter group, a large proportion of the organizations indicated that they had previously tested the product, and, because of results of these earlier tests, were not interested in testing the product further.

In April 1950, the list of possible testers was revised to exclude those organizations that expressed a specific lack of interest in testing the product. Other organizations were selected and added to the list to make a total of 50 possible testers. On April 10, 1950, samples of ALAMALT (12 one-pint glass jars) were shipped to each prospective tester. In addition, each tester was furnished (1) a description of ALAMALT, its

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<sup>9/</sup> L. M. Ware, et al., "Commercial Uses for Fully-Cooked Sweet Potato Flour." Southern Food Processing. June-July 1947.

<sup>10/</sup> For a more detailed discussion of the development, properties, and uses of ALAMALT, see L. M. Ware. "Nature of ALAYAM Products." Sweet Potato Journal. December 1946.

properties and uses; (2) selected recipes for using ALAMALT (See Appendix, pages 18 to 21); and (3) a questionnaire for recording specified test data and the opinions, attitudes, reactions, and evaluations of respondents relative to ALAMALT.

The questionnaire consisted of two parts (See Appendix, pages 22 to 24). Part I was designed to obtain an over-all appraisal and evaluation of the product. Part II consisted of a number of individual "product test sheets." These sheets were designed to obtain specific test data for each test conducted and/or different product made in testing ALAMALT. Instructions specified that a separate test sheet should be filled out for each separate test conducted and/or product made.

The data in Table 1 indicate the number of responses received from the organizations that were selected to cooperate in testing the product.

Table 1. Number of Samples Shipped, Number of Organizations Responding, and Number of Returned Usable Questionnaires and/or Comments on ALAMALT, by Kind of Organization, June 1950

Kind of organization	Number of samples shipped to specified kinds of organizations	Number of organizations responding (including both testers & non-testers)	Number of returned usable questionnaires and/or comments
	<u>Number</u>	<u>Number</u>	<u>Number</u>
Food processors and manufacturers	19	15	5
Milling companies and distributors	13	10	4
Trade organizations and laboratories	7	7	4
Candy manufacturers and confectioneries	6	4	4
Other miscellaneous organizations	5	2	2
TOTAL	50	39	19

The data in Table 1 indicate that about 80 per cent of the organizations that were asked to test the product made some type of response to the request. Of the number that responded, about one-half returned usable

questionnaires and/or comments on the product. Most of this group did not complete the questionnaire, but indicated a reaction to the product in the form of comments in a letter and/or comments on research laboratory forms designed for organizational use.

Most of the remaining number that responded indicated that, because of one reason or another, their tests had not been started or completed, but that the results of such tests would be made available at some time in the future -- if and when the tests are made. 11/

## TEST FINDINGS

Because of the kinds of answers returned by respondents and the wide variations in size, kind, and location of organizations that tested the product, this report has been prepared as a compilation of case reports. Any detailed analyses of these reports would be difficult because of the diversity of testing methods, variations in kinds of products made in testing ALAMALT, differences in kinds of answers and comments reported, and many other factors.

Test results and comments on ALAMALT have been grouped in this report on the basis of types of organizations that tested the product, Table 1. These case reports are preceded by a brief summary of earlier test findings of the Alabama Agricultural Experiment Station. Together, the test results and comments from the Station and from testing organizations indicate the extent of the product's commercial market possibilities.

To obtain the opinions, attitudes, reactions, and evaluations of ALAMALT from testing organizations, each concern was asked to report (on the questionnaire) on the following points specifically for each product made in testing ALAMALT:

1. Mixing qualities of ALAMALT.
2. Cooking properties of ALAMALT.
3. Effects of ALAMALT on finished product:
  - a. Appearance, color, etc.
  - b. Texture, quality, etc.
  - c. Flavor or taste.

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11/ In the instructions to prospective testers, it was requested that, insofar as possible, all testing be completed and all test data and comments be returned by May 15, 1950. On May 4, 1950, a letter was sent to all testers reminding them of the May 15, 1950, suspense date. Compilation of respondents' test data, comments, etc., was delayed, however, until June 15, 1950, to allow all testers as much time as possible to complete their tests and to return their test results.

4. Most important attributes (if any) of ALAMALT.
5. Most undesirable effects (if any) of ALAMALT.
6. Evaluation of the commercial possibilities of ALAMALT.

Answers to and comments on these points were highly variable. No attempt has been made in this report to explain such variations. The fact that wide variations were reported indicates the importance of recognizing such variations when attempting to determine ALAMALT'S potential commercial marketing possibilities.

Basically, the evaluations and interpretations of the test data and comments reported by respondents who tested ALAMALT are being left to those who may wish to utilize the data in actually studying the over-all problems involved in manufacturing, marketing, distributing, and utilizing the product.

In evaluating and interpreting the test data and comments reported on ALAMALT, extreme caution should be exercised. The opinions, attitudes, reactions, and evaluations reported by respondents should be considered only as reflections of their initial reactions toward the product. Such reactions may be quite different at a later date and under different economic conditions.

Test Results and Comments by the Alabama  
Agricultural Experiment Station 12/

"ALAMALT absorbs and holds moisture when exposed to air. It was found that this characteristic can be used to advantage in bakery goods in which moisture-holding quality is of great importance. For instance, ALAMALT has been used in fruit cakes, layer cakes, southern brown bread, cookies, biscuits, muffins, candies, and icings. The moisture-holding property of ALAMALT was very noticeable in the products prepared in the research kitchen. ALAMALT also has been used for pies or pre-mixed pies.

"Cakes in which ALAMALT was used were fine in texture and grain, had an elastic quality, and held moisture twice as long as plain cakes. Similarly, ALAMALT gave candies and icings a very smooth, creamy texture, and freshness. Because of this moisture-holding quality, these products remained fresh in storage over a much longer period than those containing no ALAMALT.

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12/ The test results of the Alabama Agricultural Experiment Station presented in this report were extracted from published reports and articles by Station technicians that first appeared in 1945, 1946, and 1947. They are based on test results during and prior to the period 1945-47. Results of subsequent testing by the Station are not shown in this report.

"It was found further that ALAMALT can be used to replace a portion of the eggs, butter, and sugar in cakes without loss in color, flavor, or texture. Thus, a considerable saving can be made. Also, ice cream and milk shakes can be made with ALAMALT in its natural form. These products have a very rich, creamy flavor.

"In bakery goods the best results were obtained when the ALAMALT was mixed with warm water into a thin batter-like consistency. This mixture was then placed in refrigeration for 12 to 15 hours before using. However, satisfactory results were obtained without refrigeration of the batter." 13/

"ALAMALT gives an excellent quality to icings. Icings to which ALAMALT is added are smooth and creamy in texture and retain freshness for a much longer period than those not containing it.

"The ALAMALT may be used for making pies. Opinions as to the quality of pies from the flour differ. There are some who claim that the pie is the best they had ever eaten; others claim it is a little too strong in flavor and dark in color....

"The ALAMALT does offer commercial possibilities in the preparation of a pre-mixed pie base. This product may be packaged in consumer packages or in bulk for institutional uses.... For those who prefer a strong-flavored pie, this would give quite a satisfactory product. Limited tests that have been conducted indicated that a mixture of sweetpotatoes and pumpkins make a satisfactory pre-mixed base for the sections of the country that prefer pumpkin pie to sweetpotato pie....

"Two sales tests were conducted on ice cream, one of 300 gallons... and another of 200 gallons.... According to plans, the 300 gallons...went to the trade without notice; the trade accepted the product without comment. The 200 gallon batch...went to specific stores with advance notice. Comments were favorable. Wartime regulations complicated further testing....

"ALAMALT makes an excellent milk shake if mixed properly; otherwise, the ALAMALT settles and a poor product results. The fact that one local drug store in a sales test sold over \$2,000 worth of ALAMALT milk shakes in a period of 8 months provides evidence that the public will accept the product and come back for more. It should be stated that this drug store made a superior product, advertised it, and 'pushed' its sale. Another drug store made such a poor product that the test was discontinued." 14/

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13/ Mildred S. Van deMark. "ALAMALT -- Its Properties and Uses." Alabama Agricultural Experiment Station Progress Report Series No. 23. December 1945.

14/ L. M. Ware, et al., "Commercial Uses for Fully-Cooked Sweet Potato Flour." Southern Food Processing. June-July 1947.



## Test Results and Comments by Commercial Organizations

### 1. Food processors and manufacturers

Case No. 1 (located in the Midwest). In a letter of transmittal, that included the results of a series of tests with ALAMALT, the processor stated: "We believe that it (ALAMALT) has wide application among bakeries, particularly for use in layer cakes and in sweet rolls and coffee cakes. We were favorably impressed by its flavor, its moisture absorbing and retaining properties, and by its rich color."

This organization's research laboratories made a number of products in testing ALAMALT. In each case, a regular formula was run as a control. ALAMALT was used by diluting 1 part of flour to 3 parts of warm water and refrigerated for 24 hours. The baked products were evaluated by four members of the organization's research staff at 24-, 48-, and 72-hour intervals. The following observations were made:

- "1. Yellow layer cake (130% sugar)  
(Replacing 20% of water with ALAMALT batter)
  - a. Color of crumb -- fair, slightly orange but not objectionable
  - b. Texture -- good
  - c. Eating properties -- good, moist
  - d. Flavor -- excellent, slightly unusual but combined very well with vanilla
  
- "2. Devil's food cake (140% sugar)  
(Replacing 30% of water with ALAMALT batter)
  - a. Color of crumb -- good, no difference compared to control
  - b. Texture -- good
  - c. Eating properties -- excellent, very moist
  - d. Flavor -- excellent, combined especially well with chocolate
  
- "3. Sweet rolls and coffee cakes  
(Using 4% ALAMALT batter)
  - a. Color of crumb -- good
  - b. Texture -- excellent
  - c. Eating properties -- excellent
  - d. Flavor -- excellent
  
- "4. Commercial white bread  
Batch No. 1 -- (Using 2% ALAMALT batter)
  - a. Color of crumb -- good, slightly creamy
  - b. Texture -- good
  - c. Eating properties -- excellent
  - d. Flavor -- good
  - e. General -- loaf had excellent keeping qualities, was slightly softer than control at 72-hr. mark....

Batch No. 2 -- (Using 4% ALAMALT batter)

- a. Color of crumb -- good, very creamy in color, resembling a loaf made from unbleached flour
- b. Texture -- good
- c. Eating properties -- good
- d. Flavor -- excellent
- e. General -- loaf had excellent keeping qualities, but very little difference compared to the 2% loaf

Batch No. 3 -- (Using 2% dry ALAMALT flour)

- a. Color of crumb -- poor, too dark
- b. Texture -- poor, too open
- c. Eating properties -- good
- d. Flavor -- good
- e. General -- crumb structure and texture was definitely affected at this level

#### "5. Cookies

Old fashioned sugar

- a. Color of crumb -- poor, too dark
- b. Texture -- poor
- c. Eating properties -- poor, too brittle
- d. Flavor -- fair

Butterscotch

- a. Color of crumb -- good
- b. Texture -- poor
- c. Eating properties -- poor, too brittle
- d. Flavor -- good

"In summing up these tests, it was found that the ALAMALT product did produce improvement in such products as devil's food cake, sweet rolls, coffee cake, and commercial white bread. In the case of the yellow layer cake, a new type cake was created due to the color and flavor being entirely different...."

"In the type cookies made, the ALAMALT product did not produce improvement. The finished cookies were very brittle...."

Case No. 2 (located in the Midwest). This concern made eight (8) different products in testing ALAMALT. Products made were spice cake, devil's food cake, southern brown bread, fruit cake, biscuits, muffins, chocolate frosting, and spiced pie.

This organization reported best results with southern brown bread and devil's food cake; poorest results were with biscuits. It reported the most important attributes of ALAMALT as "color and absorption of moisture." It stated that "flavor was not always acceptable. Also, in dry form, it was difficult to mix without lumping."

In evaluating the commercial possibilities of the product, this concern stated that ALAMALT "might be of value in the manufacture of bakery products."

Comments on individual products included the following:

Southern brown bread -- Mixing qualities of ALAMALT were "very good. The finished product had a good appearance and a good color. Its texture was acceptable. Its flavor or taste was good -- ALAMALT was not as apparent as in other recipes."

Devil's food cake -- ALAMALT was "easily mixed in batter form. The product had a good appearance. Its texture was good, but was slightly gummy. Its flavor was acceptable."

Spice cake -- ALAMALT was "easily mixed in batter form. Its cooking properties were acceptable. The finished product had a fairly good appearance, although it was not the color usually associated with spice cakes. Its texture was slightly gummy but otherwise acceptable. Its flavor was also acceptable."

Chocolate fudge frosting -- ALAMALT "does not seem to affect cooking properties. When combined with chocolate, it is not apparent in the color or appearance of the finished product. Both the texture and flavor of the finished product were good. Unless ALAMALT would help retain moisture, its suitability would be questionable in this product."

Muffins -- The mixing qualities of ALAMALT were "very good. The finished product had a nice color and appearance. Its texture was good, but slightly peaked from heating. Its flavor was fair -- it had a bitter taste."

Spiced pie -- The ALAMALT was "not easily mixed; it was inclined to lump. Its cooking properties were good and it thickened nicely. The final product had a very good color and appearance. Its texture was good. The flavor was fair."

Fruit cake -- ALAMALT's mixing qualities were "good; it was easily mixed. In cooking, it took a much longer baking time than the usual recipe. The finished product was a little sunken; its color was good. In texture, it was too wet inside. Its final flavor was good. One hour after baking, the product did not cut well. It seemed gummy and wet inside. ALAMALT might be of use in retaining moisture in fruit cakes."

Biscuits -- ALAMALT's mixing qualities were "good. Its cooking properties were poor; the biscuits did not rise properly. The finished product was poor in color, appearance, texture, quality, taste, and flavor. This product was one of the least acceptable."

Case No. 3 (located in the Northeast). "We did several experiments with ALAMALT.... Our impression of the resulting product is as follows:

- "1. Product took longer to bake at the suggested temperature.
- "2. Slightly 'heavier' product resulted.
- "3. Flavor of the ALAMALT was discernible until the product had been aged for 24 hours.
- "4. Product remained moist upon aging for 96 hours."

Case No. 4 (located in the Midwest). "We had thought to use the ALAMALT as a filler but the process you (the manufacturer) used in preparing the product evidently destroyed the jelling properties by converting the starch to sugar.

"On our products we believe it has no value as thickener, would give too dark color and its flavor would mask flavors...which we are trying to emphasize."

Case No. 5 (located in the Northeast). "This will advise that our tests are not completed but we feel that the product has very limited use in our work...."

## 2. Milling companies and distributors

Case No. 6 (located in the Midwest). "...ALAMALT, when reconstituted, has a very poor flavor ... The flavor is rather typical of that which one obtains with highly pigmented vegetables after storage, and while the products may have been good when fresh, it would appear that the stability problem is a serious one and would mitigate against successful commercial usage.

"ALAMALT has been tested in a plain cake and a plain muffin...."

"From our observations, we have seen no advantages for using ALAMALT in these baked products.... We made the plain yellow cake using all eggs (required by the recipe), and another in which 25 per cent of the egg was replaced with ALAMALT. No significant difference was noted in the tenderness of these two cakes. However, we did object to the color and flavor which ALAMALT gave the cake. The cake batter containing ALAMALT was thicker and the grain of the cake was uneven."

Case No. 7 (located in the Midwest). This organization did not test the product, but commented as follows:

"The only drawback that we can see at the moment is that ALAMALT is hygroscopic and, since most prepared pancake flours are packed in so-called

delta-seal bags, i.e., the tops of the bags being folded over and sealed with an adhesive, such bags would not be sealed tightly enough to prevent the mixture from drawing moisture...."

Case No. 8 (located in the Midwest). "...at the moment, we do not see any place where this product may be used in our mixes. One of the main objections that we have to it is an undesirable, rather persistent 'after-flavor'.

"I may say that personally I am fond of sweetpotatoes and the initial taste from ALAMALT is like sweetpotato, but this after-taste is quite undesirable. We tried out products containing ALAMALT on several people and it is my feeling that very probably our northern palates are not sufficiently educated on the merits of sweetpotato flour."

Case No. 9 (located in the Far West). "We examined this product and find it to be a very unique item, very pleasant and palatable in taste, and it should fit into many food items once its nutritional value is known.

"...(in) bread baking and in minimum amounts it does no particular harm to the bread except with higher amounts it begins to open up and make the grain of the loaf heavy and darker in color."

### 3. Trade organizations and laboratories

Case No. 10 (located in the Northeast). "We...have to date made two tests with this ingredient....

"One test was made in a layer cake with 130 sugar-flour ratio.... We used our own formula.... This addition (ALAMALT) caused practically no change in cake volume; grain was coarsened a little; texture was a little harsher; and color was very considerably darker and brownish-gray. The cake was moister than the control and also gummier in eating characteristics. Flavor was considerably changed but various observers were not in agreement as to desirability of the change. Sweetness had been reduced and a slightly tangy flavor added that might be of value in specialty products.

"...ALAMALT was tried in (ordinary bread)...since this would be a major market if useful. It was used in a level of somewhere between 2 and 3 per cent of the dry ingredient in relation to flour weight. This made doughs more sticky and caused them to have less toughness. Crumb color was made very brownish-yellow. Other loaf characteristics, such as volume, texture, grain, and loaf shape, were not appreciably changed. It caused bread to remain soft considerably longer than the control product but was not equal to regular bread containing polyoxyethylene stearate in this respect. Bread was also quite gummy and there was a rather pronounced and undesirable effect upon flavor.

"...Some further tests may be made in a few other cake types but it seems quite definite that this ingredient does not belong in ordinary bread. It is also so damaging to doughs or batters that only relatively small levels could be used in any product, in our opinion. It does have the property of increasing softness and keeping quality, but this may not be enough to give it a place in baked products in view of its relatively drastic action on wheat flour gluten."

Case No. 11 (located in the Midwest). "I made a milk chocolate cake which normally called for a percentage of cooked and mashed potatoes. I replaced the mashed potato portion with ALAMALT and had very good results.

"Following this, I made two batches of sponge cake. One was what would normally be called 'potato flour sponge cake' and was taken from a home cook book. I transposed this into a baker's formula....

"The resulting cakes...were not at all satisfactory, and I believe the main trouble I had then was that the ALAMALT does not have the same absorption property as does regular Idaho or Michigan potato flour -- these flours usually take on 4 times the water weight of their own weight in bakery products....

"The cakes made from ALAMALT over-expanded, then dropped completely. They were over-moist and, of course, had a very strong sweetpotato flavor.

"I then made a second batch of sponge cake using a straight old fashioned sponge cake formula. I replaced 1/8 of the total flour weight with ALAMALT.

"These cakes, while much better than the first sponge cakes, were still not good merchandise. The color of the cake was somewhat mustard-colored -- the crumb was dry and the texture was open -- too open."

Case No. 12 (located in the Midwest). "The products which we made were biscuits and muffins.

"Both of these quick breads had the color of ALAMALT as well as its characteristic sweet flavor. Since ALAMALT is fairly high in sugar, the baked products seemed somewhat more moist on the tongue than biscuits and muffins usually are. This sensation of moistness increased as the breads became cold. It increased even more when the products were held over to the second day. The ALAMALT content of the breads seemed to give them a hygroscopic quality.... Of the two products, we preferred the muffins, since we thought the sweet flavor and darker color made the biscuits too different from the type of product most consumers associate with biscuits."

Case No. 13 (located in the Midwest). "...I have found that an addition of ALAMALT to dry mixtures of puddings makes a well-flavored dish and

most people who have tasted it have claimed it to be something new and very palatable."

#### 4. Candy manufacturers and confectioneries

Case No. 14 (located in the Northeast). "Our Production Manager made a couple of experiments with this product in cookies but (with) not too satisfactory results.

"The net results of our tests were that the product proved too sticky for use on our steel-band-type ovens and did not have any special flavor or other qualities which would make it work better in products, either new or old, than our own formulas....

"There is no question this product probably has beneficial qualities for the soft-goods type of bakery, but in our line we have a specialized type of formula and steel-band ovens which do not fit into the picture very well."

Case No. 15 (located in the Midwest). "We used three of our regular production formulas for checking ALAMALT -- a fondant formula, a marshmallow formula, and a hard candy formula.

"Twelve persons were taste-tested on the finished candies. None objected to the taste or color of the candy. No real enthusiasm, however, was evident for the ALAMALT. A decided preference was given to the regular formula.

"The ALAMALT worked well in both the fondant and marshmallow formulas. It was decidedly objectionable in the hard candy formula."

Case No. 16 (located in the Southeast). "We have been familiar with ALAMALT for a number of years.... There is no way that we have been able to find whereby we can use ALAMALT in our manufacturing. We are not interested in making further experiments at this time."

Case No. 17 (located in the Midwest). "ALAMALT...should be successful in the soda fountain trade. This risk, I feel, would be too great in the candy bar field, as it would require a great deal of experimentation, taste-test surveys, and advertising, in order to make it successful. As the northeastern part of our country is not too well acquainted with the taste of sweetpotatoes, some chances would be taken in its acceptability. Therefore, we feel that we are not interested, at this particular time, in the product."

## 5. Other miscellaneous organizations

Case No. 18 (located on the Pacific Coast). "In my experience with ALAMALT...I find that it works well in yeast-raised goods containing eggs. It makes for a richer product and brings out a pronounced golden color.... I tried it in the starter yeast of my salt-rising bread.... It came out all right, except that it showed up plain on the crust in a speckled form. It might show up the same in a white loaf of bread from compressed yeast.

"ALAMALT possesses what I might term sweet-sugar crystals that do not absorb easily, especially in prepared cake-doughnut flour.... ALAMALT has a rich brown color which is imparted to all baked goods in which it was used. The more used, the more pronounced was the color.

"ALAMALT does not absorb water or milk as does white or common potato flour.... (It) did not increase the value of our products, but it did show up in color very plain; also in taste and odor just out of the oven. None of our customers voiced any objections."

Case No. 19 (located in the Northeast). "If...ALAMALT holds moisture, and therefore is especially good in cakes, muffins, and soft cookies, then it would seem the bakery industry would welcome it. We didn't find the devil's food cake made with ALAMALT stayed moist after 5 days in the tin-lined, airtight drawer. It was dry and crumbly...."

"In making the devil's food cake with ALAMALT, we found that it was not easy to mix the batter. It took 3 to 5 minutes because it (ALAMALT) lumps. Putting in ALAMALT is an extra step in making the cake. In the finished product, the cake didn't look any different from other cakes. Our panel of taste-testers were unaware of any difference in this cake, though they liked it the same as a good standard devil's food cake. It did not have as much red color as some have. The panel detected no flavor difference. We held the cake for 5 days to see if, because of ALAMALT, the cake was more moist than cakes usually are. The ALAMALT devil's food cake was dry and crumbly though stored in a tin-lined airtight container.

"Most of the recipes...use very little ALAMALT and can be successfully made without it. For this reason, I foresee consumer resistance to ALAMALT -- it's extra work to mix up, and mix in the ALAMALT batter; yet it doesn't impart a distinct flavor; it also represents additional cost."



## SUMMARY and CONCLUSIONS

During the period 1942-45, research technicians at the Alabama Agricultural Experiment Station developed a number of new food products from sweetpotatoes under the brand name Alayam products. Among the more promising of these new products was ALAMALT -- a fully-cooked sweetpotato flour.

This report presents the results of a nation-wide acceptance test of ALAMALT by commercial food manufacturers, processors, and distributors. It also presents a summary of earlier test findings of the Alabama Agricultural Experiment Station. Together, these test results indicate the extent of the product's commercial possibilities.

Test results and comments by testing organizations varied widely. These variations emphasize the importance of their recognition as factors affecting the potential commercial possibilities of the product.

In the aggregate, reactions to ALAMALT were not favorable. Testing organizations had strong opinions regarding the undesirable characteristics and effects of ALAMALT. On the other hand, opinions regarding the attributes of ALAMALT were varied and somewhat vague. This point deserves major emphasis. A significant portion of the organizations that tested ALAMALT either were not impressed or were not satisfied with the product. This, therefore, is a major factor limiting the immediate potential commercial possibilities of ALAMALT.

Basically, the evaluations and interpretations of the test data and comments reported by testing organizations are being left to those who may wish to utilize the data in studying the over-all problems involved in manufacturing, marketing, distributing, and/or utilizing the product.

In evaluating and interpreting the test data and comments reported on ALAMALT, extreme caution should be exercised. The opinions, attitudes, reactions, and evaluations reported by testing organizations should be considered only as reflections of their initial reactions toward the product. Such reactions may be different at a later date and under different economic conditions.

APPENDIX

Selected Recipes for Using ALAMALT 1/

Fruit Cake

1/2 c. butter	1 c. nuts
1 c. sugar	1 t. cinnamon
1 c. applesauce	1/2 t. cloves
1 t. soda	1-1/3 c. white flour
1/4 c. milk	2/3 c. ALAMALT (dry)
1 c. raisins	

Cream butter and add sugar gradually. Add soda to applesauce, and mix with butter and sugar. Combine ALAMALT with flour and add alternately with milk, stirring well. Add raisins and nuts that have been floured slightly. Bake in greased pan at 350° F. for 1 hour.

Devil's Food Cake

2 c. flour	3 eggs (well beaten)
2-3/4 t. baking powder	3 squares unsweetened chocolate
1/4 t. salt	3/4 c. milk
2/3 c. shortening	1 t. vanilla
1-1/2 c. sugar	4 T. ALAMALT (batter) 2/

Sift flour, measure, and add baking powder and salt. Sift this mixture three times. Cream shortening, add sugar slowly, and cream until light. Add eggs and beat well. Mix in chocolate. Add flour alternately with milk, beating smooth. Add ALAMALT batter and vanilla. Bake in two layers for 30 minutes at 350° F.

Spice Cake

2-1/2 c. flour	1/2 c. shortening
2-1/2 t. baking powder	1 c. sugar
1/4 t. salt	2 eggs
1 t. cinnamon	1/3 c. molasses
1/4 t. cloves	3/4 c. milk
4 T. ALAMALT (batter)	

Sift flour, measure, and add baking powder, salt, and spices. Sift this mixture three times. Cream shortening, add sugar gradually, and cream until light. Mix in well-beaten eggs. Add molasses and ALAMALT batter, blending together well. Add flour alternately with milk, beating after each addition. Bake for 30 minutes at 350° F.

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1/ Adapted from Mildred S. Van deMark. "ALAMALT--Its Properties and Uses." Alabama Agricultural Experiment Station Progress Report Series No. 23. December 1945.

2/ Mix ALAMALT with warm water to make a thin batter consistency. If time permits, place in refrigerator and let stand overnight, or 12 to 15 hours before using.

### Alayam Rocks

1-1/2 c. brown sugar	1/4 t. salt	2/3 c. nuts
2/3 c. butter	1/4 t. cloves	2/3 c. raisins
2 eggs	2-1/2 c. flour	1 t. vanilla
1 t. cinnamon	1 t. soda	1 T. milk
4 T. ALAMALT (batter)		

Cream butter, add sugar, vanilla, well-beaten eggs, and ALAMALT batter. Sift dry ingredients together and add to first mixture alternately with milk. Mix in nuts and raisins. Drop by spoonfuls on a greased tin, and bake in 350° F. oven 15 to 20 minutes.

### Southern Brown Bread

3/4 c. ALAMALT (batter)	2 t. soda
1 c. corn meal	1 c. molasses
1-1/4 c. whole wheat flour	2 c. buttermilk
1/2 c. bran	2 c. raisins
1 t. salt	

Mix the dry ingredients thoroughly. Add molasses, buttermilk, and ALAMALT batter. Fold in raisins, slightly floured. Fill cans 3/4 full and steam for 2-1/2 hours in 4 well-greased No. 2 cans. Remove lids and dry bread 1/2 hour in a moderately hot oven.

### Fudge (ALAMALT and Fondant)

2 c. sugar	3 T. light corn syrup	2 T. butter
2/3 c. milk	3 T. ALAMALT (batter)	2 t. vanilla
8 T. cocoa	3/4 c. fondant	2 c. pecans

Put sugar, milk, chocolate, ALAMALT, and corn syrup in a sauce pan. Cook slowly until temperature of 236° F. is reached. Remove and add butter, vanilla, and fondant. Beat well. Add pecans, mix and pour on a buttered tin to cool. Cut.

### Pralines

1 c. brown sugar	1 c. white sugar
1 c. milk	1/16 t. soda
2/3 c. ALAMALT (dry)	1 T. butter
1/2 t. maple flavoring	1-1/2 c. pecan (halves)

Combine sugars, milk, and soda. Cook to 236° F. Remove from heat, add butter and flavoring. Whip until crystallization begins, and add ALAMALT. Mix thoroughly and drop by spoonfuls over pieces of pecans that have been placed on waxed paper.

### Chocolate Fudge Icing

2 c. sugar	1 t. vanilla	1 T. butter
1 c. milk	4 T. cocoa	2 T. ALAMALT (batter)

Cook the sugar, ALAMALT, milk, and chocolate until it forms a soft ball when tried in cold water (230° F.). Remove from fire, add butter and vanilla, and beat until of right consistency to spread on cake.

(Lemon-cheese icing also may be made successfully with ALAMALT, using 1 tablespoonful ALAMALT to 1 cup sugar. Moisture is retained twice as long as in standard recipes.)

### Caramel Frosting

1-1/2 c. brown sugar	1-1/2 c. milk
1-1/2 c. granulated sugar	2 T. butter
2 T. ALAMALT (batter)	

Combine sugar, ALAMALT, and milk and bring to a boil, stirring constantly. Then boil without stirring until a small amount of the mixture forms a soft ball in cold water (232° F.). Add butter and beat until of right consistency to spread on cake.

### Spiced Pie

2/3 c. ALAMALT (dry)	1 t. lemon flavoring
1/2 c. sugar	1-1/4 c. milk
1 egg	2 T. butter
1-1/2 t. mixed spices	1/2 t. salt

Whip egg and mix in sugar. Combine ALAMALT with other dry ingredients and add alternately with milk to egg and sugar. Add flavoring and butter, mix thoroughly, and pour into a baked pie shell. Bake for 45 minutes at 325° F.

### Biscuit

1-2/3 c. flour	1/2 t. salt
1/3 c. ALAMALT (dry)	3 T. fat
1/2 t. soda	1-1/3 c. sour milk

Mix and sift all dry ingredients. Cut in fat with pastry mixer. Add enough milk to make soft dough. Knead to make smooth. Roll to 1/2 inch thick and cut. Bake in hot oven (425° F.) 15 to 18 minutes.

### Muffins

1-3/4 c. flour	1 egg
1/4 c. AIAMALT (dry)	2 T. sugar
3 T. fat	1/2 t. salt
1-1/4 c. milk	4 t. baking powder

Mix and sift all dry ingredients. Beat egg and to it add part of the milk. Add this to dry ingredients. Mix in melted fat and remaining milk. Beat well and put into muffin rings filling them about half full. Bake in hot oven (400° F.) for 35 to 40 minutes.

### Ice Cream

1 qt. milk	8 T. Dry skim milk
1 qt. cream	1 t. vanilla
1-1/2 c. sugar	1 t. kragel or gelatin
10 T. AIAMALT (dry)	

Heat milk in double boiler to 80° F. Add the combined sugar, dry skim milk, kragel, and sweetpotato malt. Raise temperature to 150° F. and let remain for 30 minutes. Cool, add vanilla and cream. Freeze.

### AIAMALT Milk Shakes

1 c. milk (1/2 pint)	2 scoops ice cream
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Place milk in mixer, add malt, flavoring, and ice cream. Whip throughly. Serve.

QUESTIONNAIRE

PART I -- "REACTIONS TO ALAMALT"

Organization \_\_\_\_\_ Date \_\_\_\_\_

Address \_\_\_\_\_ Name and title of person completing  
this questionnaire: \_\_\_\_\_

1. What are the principal products manufactured by your organization?

(a) \_\_\_\_\_ (c) \_\_\_\_\_

(b) \_\_\_\_\_ (d) \_\_\_\_\_

2. What products did you make in testing ALAMALT?

(a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_ (d) \_\_\_\_\_

3. Did you use API or your own recipes in making each of these products?

(a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_ (d) \_\_\_\_\_

4. In which of the products that you made did ALAMALT give:

(a) Best results? \_\_\_\_\_ (b) Poorest results? \_\_\_\_\_

5. As an ingredient of the products you made in testing ALAMALT:

(a) What were the most important attributes (if any) of ALAMALT? \_\_\_\_\_  
\_\_\_\_\_

(b) What were the most undesirable effects (if any) of ALAMALT upon  
the products made? \_\_\_\_\_  
\_\_\_\_\_

6. On the basis of the tests you made, evaluate the commercial possibilities of ALAMALT: \_\_\_\_\_  
\_\_\_\_\_

7. (a) If ALAMALT were available, would you use it as an ingredient of  
some of the products manufactured by your organization? \_\_\_\_\_

(b) If YES, what products? \_\_\_\_\_

(c) If NO, why? \_\_\_\_\_

PART II -- "PRODUCT TEST SHEET"

(Use a separate "Product Test Sheet" for each product made)

Organization \_\_\_\_\_ Address \_\_\_\_\_ Date \_\_\_\_\_

Name and title of person completing this questionnaire \_\_\_\_\_

Product made \_\_\_\_\_ Test Number \_\_\_\_\_ API or your own recipe \_\_\_\_\_

I. Based on your experience in making this product, write in your observations (immediately after making the product) with respect to the following specific points:

Items	What was your general reaction to ALAMALT as an ingredient of this product?	How did the product made with ALAMALT differ from similar products made without ALAMALT?	Which of the products possessed the most desirable features?
Mixing qualities in preparation, etc.			
Cooking properties, etc. (if applicable)			
Effects on finished product: a. Appearance, color, etc.			
b. Texture, moisture, firmness, graininess, cracking, etc.			
c. Flavor or taste			
Other comments			

(Cont'd)

PART II -- "PRODUCT TEST SHEET" (Cont'd)

II. What were the general conditions 1/ of the products made with and without ALAMALT after being storage for various intervals of time?

Storage time (from hour of making)	Product made <u>with</u> ALAMALT	Product made <u>without</u> ALAMALT	Specify the general storage conditions under which these products were stored:
Immediately after making	(See Question I)	(See Question I)	1. What size sample of the products was placed in storage? _____
_____ hours later			2. Were containers used? _____ Kind _____
_____ hours later			3. Was wrapping used? _____ Kind _____
_____ hours later			4. Humidity _____
_____ hours later			5. Temperature _____
_____ hours later			6. Presence of light _____ _____ _____
_____ hours later			7. Other _____ _____ _____
Total estimated shelf- life of product	_____ days	_____ days	

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1/ General conditions include all characteristics of the finished product. Answers would indicate the degree of specific changes (if any) in such characteristics as they occur whether desirable or undesirable. For instance, 24 hours after making a product, its color may become darker or lighter, texture may become more grainy or more soggy, flavor may become more rancid, less rancid, etc.