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Acceptance of an IMPROVED *Frozen* SWEETPOTATO PUREE



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Acceptance of an IMPROVED *Frozen* SWEETPOTATO PUREE¹

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PRODUCTION OF SWEETPOTATOES in the United States and in Alabama has shown a continuous decline during the past decade. National production in 1956 was 19 per cent below 1955 and 16 per cent below the 1945-54 average.³ In Alabama, 1956 production was 25 per cent below 1955 and 30 per cent below the 10-year average. In 1956, only 14,000 acres were harvested in Alabama, 22 per cent below 1955 and 59 per cent below the 10-year average.

National per capita consumption of sweetpotatoes also declined since 1945, from 18 to 7 pounds in 1954.⁴ This decline in production and consumption occurred during a period of steadily increasing consumer incomes and declining numbers of rural-farm population. Undoubtedly, many persons who left farms found employment in industry. These factors, as well as production and marketing problems, contributed to the decreasing importance of commercial sweetpotato production.

One of the major problems of commercial producers in recent years has been that of finding a profitable market outlet for Number 2 and Jumbo grades of sweetpotatoes. These off-size or off-shape potatoes usually can be marketed only at unsatisfactory prices. Improved varieties and better production techniques have

¹ This project was supported by funds provided for by Section 204 (B) of the Agricultural Marketing Act of 1946 (Title II).

² Resigned; now assistant horticulturist.

³ Crop Production, Annual Summary, December 1956, Crop Reporting Board, Agricultural Marketing Service, USDA, Washington, D.C.

⁴ Agricultural Statistics, 1955, USDA, Washington, D.C.

helped to reduce the quantity of off-size and off-shape potatoes, but the problem of finding market outlets for these grades remains.

Research work has been underway for several years in the Department of Horticulture, Agricultural Experiment Station of the Alabama Polytechnic Institute, directed at developing new products from sweetpotatoes — products that would utilize sweetpotatoes not suitable for the fresh market as well as for market-type sweetpotatoes. Earlier research, started in 1942, placed major emphasis on the development of candies and other prepared foods made from sweetpotatoes. A number of different candies and specialty products were developed.⁵ Nationwide acceptance tests of these products were conducted to obtain consumer reactions to the products.⁶ Also, as a part of these tests, reactions were obtained from commercial users with regard to a fully cooked sweet-potato flour.⁷

In recent years, the smaller acreage devoted to sweetpotatoes and the decreased per capita consumption have created concern for the future of sweetpotatoes as an important cash crop in Alabama. In addition, the need for an outlet to utilize off-shape and off-size sweetpotatoes still exists. Thus, interest has been renewed in developing new products primarily as improved frozen and canned products. One of the most promising appears to be a sugar-cooked, concentrated frozen sweetpotato puree suitable for making pie and soufflé. It was felt that this product was highly adapted for general consumer use and particularly adapted to institutional use, such as commercial cafeterias. This study was an attempt to determine the acceptance of this product by commercial and school cafeterias.

Specific objectives of the study were:

- (1) To measure acceptance of an improved, sugar-cooked, frozen sweetpotato puree by commercial cafeterias and school lunch cafeterias.
- (2) To determine the desirability of this puree for prepared selected products.

⁵ Ware, L. M., Nature of Alayam Products. Sweetpotato Journal. December 1946.

⁶ Lanham, Ben T., Jr., Consumer Reactions to "Alayam" Candy, Snacks, and Breakfast Food. Bulletins 271, 272, 273. API Agricultural Experiment Station, Auburn, Alabama. 1950.

⁷ Lanham, Ben T., Jr., Consumer Reactions to Alamalt—A Fully Cooked Sweetpotato Flour. Progress Report Series No. 46, API Agricultural Experiment Station, Auburn, Alabama. 1950.

CHARACTERISTICS *of* SUGAR-COOKED FROZEN SWEETPOTATO PUREE⁸

Sweetpotato puree is made either from a single variety or from a blend of several varieties of sweetpotatoes. Blending varieties results in greater uniformity of color, texture, and flavor than is obtained by processing different varieties separately. The finished puree has an attractive orange color, smooth, fairly firm texture, and an outstandingly good sweetpotato flavor. The product is concentrated to approximately 40 per cent total solids during the cooking process. Practically all of the fiber or other "hard" particles are removed during the pulping process. In using this puree a relatively short cooking time is required in making the finished product. Storage life has not definitely been determined, but keeping quality appears to be good.

METHOD *of* STUDY

Interest in testing this product with commercial cafeterias resulted partly from the highly favorable reaction of the Food Service Department of the Alabama Polytechnic Institute to frozen sweetpotato puree. The Department of Horticulture has furnished the API Food Service Department and a number of school cafeterias with the product for the last 3 years.⁹ In addition, it was felt that commercial cafeterias would furnish ideal outlets because of the nature of their operations. Commercial cafeterias and other similar institutions have reasonably uniform, standardized serving procedures and use rather large quantities of products in their operations. Five commercial and 14 school cafeterias cooperated in testing the product during the 1955-56 period.

Each cafeteria was furnished a schedule to be filled in by the cooperating managers. The schedule provided space for evaluat-

⁸ Sweetpotatoes used were peeled by steam pressure and washed in water. Ends and unpeeled spots were removed by hand trimming. The peeled potatoes were cooked in added sugar, pulped to remove fiber, and packed into 36- and 60-pound tin containers. A slow freeze process was used to bring the potato puree to 0° Fahrenheit. A detailed description of the process is available from Hubert Harris, associate horticulturist, Department of Horticulture, Auburn, Ala., upon request.

⁹ The API Food Service Department purchases and prepares food for all students who live in quarters furnished by the college. Meals are served cafeteria style. In addition, catering is regularly done and one cafeteria serves the general public. This latter cafeteria offered frozen sweetpotato puree at least weekly during the 1956-57 school year to an average of 1,200 patrons daily, about half of whom chose soufflé made from improved puree when it was offered. Approximately 25,000 pounds of puree has been furnished the Food Service Department in the last 3 years.



Commercial cafeterias served pie and souffle made from improved sugar-cooked frozen sweetpotato puree during acceptance study.

ing the physical characteristics of the product and for recording costs incurred in using the product. Commercial cafeterias were asked to feature the product as souffle and/or pie on the regular noon and evening menus for about 1 week. Schools were asked to feature it on 5 regular school days. The frozen puree was supplied by the API Agricultural Experiment Station at 12 and 15 cents per pound to commercial and school cafeterias, respectively. The price differential was based on transportation arrangements and volume used.

Four commercial cafeterias were located in Alabama and 1 in Florida. Three were independent operations and 2 were chains. Annual gross sales were in excess of \$500,000 in 3 operations and from \$100,000 to \$300,000 in the other 2. Four of the cafeterias were located in business districts and 1 in a shopping center. School cafeterias were of four general types, senior high, junior high, grammar, and consolidated. All were located within a radius of about 30 miles of Auburn.

The data obtained from these cafeterias provide an indication of the value of the product for commercial use in serving consumers. No attempt was made to evaluate the efficiency of these cafeterias in using the product. Costs apply only to materials

used in preparation of the products, whereas returns are based on the selling price of the prepared products.

PREPARATION *and* SERVING METHODS

Commercial Cafeterias

Three of the 5 commercial cafeterias featured the product as soufflé and all 5 featured it as pie. Each cafeteria prepared products from their own recipes (see appendix), which particularly for soufflé accounts in part for the wide differences in number of servings obtained per pound of puree used, Table 1. Rather generous servings were offered, however, in cafeterias 1 and 2. Pounds of puree used varied with the different cafeterias as did the number of servings obtained from each pound served. For example, for soufflé, cafeteria 3 used much less puree in relation to other materials; in preparing pie, cafeteria 4 used more puree in relation to other materials. Undoubtedly, these conditions markedly affected quality of the finished products.

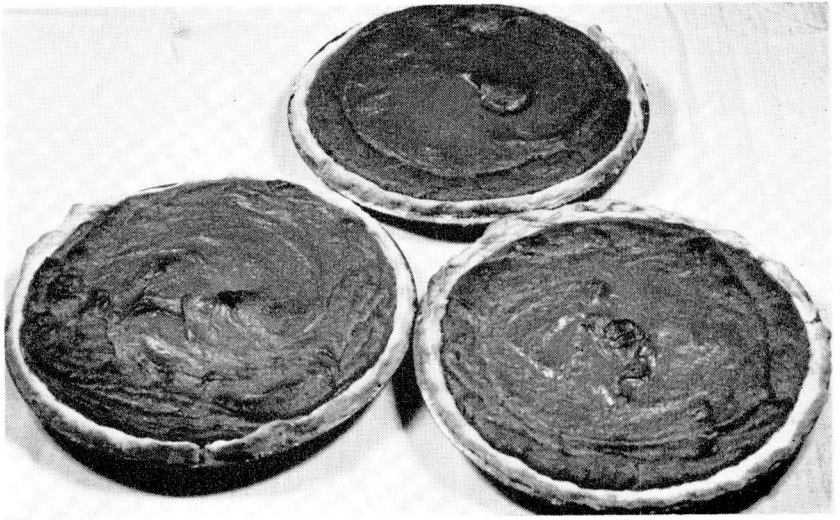
Consumer purchases of soufflé and pie varied for the different cafeterias. There was no indication that sales of the product increased from beginning to end of the test period, but products were prepared in conservative quantities. Once the supply was exhausted, no effort was made to replenish the supply. Cafeterias 2 and 5 experienced sell-outs of pie on several days in featuring the product. No comparison was made between soufflé and any one vegetable, but generally 6 to 8 vegetables were offered in

TABLE 1. PERCENTAGE OF FOOD COST TO SALES INCURRED BY COMMERCIAL CAFETERIAS IN TESTING THE IMPROVED SWEETPOTATO PUREE, 1955-56

Cafeteria	Amount of potato puree used	Servings per pound of puree	Cost of materials in finished product ¹	Percentage food cost to sales ²
<i>Number</i>	<i>Pounds</i>	<i>Number</i>	<i>Dollars</i>	<i>Per cent</i>
Potato soufflé				
1.....	200	3.50	40.19	42.7
2.....	904	3.23	169.51	41.6
3.....	79	7.11	21.33	25.3
Potato pie				
1.....	65	6.00	24.31	48.1
2.....	330	6.82	99.51	31.2
3.....	43	8.00	16.00	31.0
4.....	202	4.62	53.01	42.0
5.....	233	6.00	81.74	39.9

¹ Potato puree cost 12 cents per pound.

² Percentage of food cost to sales was determined by dividing the total cost of materials for preparing the product by the total sales of the product.



These pies were prepared from the improved puree developed at Auburn.

competition with the sweetpotato product. The same was true for pie with competition being from 8 to 10 different desserts offered. Percentage of patrons eating either souffle or pie made from the improved product are shown in Table 2.

About 9 per cent of all patrons in the three cafeterias that served souffle chose the product. One out of 5 patrons of the smallest cafeteria chose souffle, while 1 out of 12 chose the product in the larger cafeterias. With a larger number of choices of-

TABLE 2. PERCENTAGE OF PATRONS THAT PURCHASED IMPROVED SWEETPOTATO PRODUCTS IN SELECTED COMMERCIAL CAFETERIAS, 1955-56

Cafeteria	Total patrons	Total servings consumed	Percentage of patrons eating improved product
<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Per cent</i>
Potato souffle			
1.....	7,920	628	7.9
2.....	32,165	2,714	8.4
3.....	2,496	562	22.5
All.....	42,581	3,904	9.2
Potato pie			
1.....	7,920	337	4.3
2.....	32,165	2,126	6.6
3.....	2,496	344	13.8
4.....	23,801	833	3.5
5.....	20,147	1,365	6.8
All.....	86,529	5,005	5.8

TABLE 3. PERCENTAGE OF IMPROVED SWEETPOTATO PRODUCTS OF ALL ITEMS SERVED IN SELECTED COMMERCIAL CAFETERIAS, 1955-56

Cafeteria	Total vegetable or dessert items served	Servings of sweetpotato product	Percentage sweetpotato product of all items
<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>
Potato souffle			
1.....	11,603	628	5.4
2.....	26,198	2,714	10.4
3.....	5,093	562	11.0
All.....	42,894	3,904	9.1
Potato pie			
1.....	6,397	337	5.3
2.....	13,614	2,126	15.6
3.....	1,988	344	17.3
4.....	15,720	833	5.3
5.....	12,588	1,365	10.8
All.....	50,307	5,005	10.0

ferred among desserts than for vegetables, about 6 per cent of the patrons in all cafeterias chose the improved sweetpotato pie. One out of 7 patrons of the smallest cafeteria chose sweetpotato pie, as compared with 1 out of 14 patrons of the largest cafeteria. Cafeteria 4 had rather disappointing results with pie, but it was previously noted that this cafeteria used proportionately a greater amount of puree than did other cafeterias.

Results showing percentage of improved sweetpotato products of all vegetable or dessert items sold are shown in Table 3. Competing with 6 to 8 vegetable items, sweetpotato souffle was chosen in 1 out of 11 instances for all cafeterias reporting. Only 3 cafeterias prepared souffle, but 2 of the 3 had satisfactory results. Results with sweetpotato pie, in general, were good. In competition with 8 to 10 dessert items, the improved pie accounted for 10 per cent of the items sold in all cafeterias. Cafeterias 1 and 4 did not have results nearly as satisfactory as the other three, however. As reported earlier, if supplies of the improved products were exhausted during a serving period they were not replaced. Improved products were not featured but were displayed with the general assortment of competing items.

School Cafeterias

Schools cooperating in making tests with frozen puree offered it at the regular noon meal as souffle only. Each cafeteria used its own recipes in preparing the product, which partly accounts



Sweetpotato souffle was served by commercial and school cafeterias in study.

for the wide differences in the number of servings obtained from each pound of puree. Schools were asked to feature the product on 5 different occasions, but the number of times offered varied from 1 to 5 with the different cafeterias

There were variations between servings per pound and cost per serving, but generally as the number of servings increased the

TABLE 4. RESULTS OF TESTS WITH IMPROVED SWEETPOTATO SOUFFLE IN 12 SCHOOL CAFETERIAS, 1956

School	Times product was served	Servings consumed	Amount of puree used	Servings per pound	Cost per serving ¹
<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Pounds</i>	<i>Number</i>	<i>Cents</i>
1.....	5	1,084	190	5.70	3.01
2.....	5	1,569	180	8.70	3.28
3.....	5	1,348	232	5.81	3.01
4.....	5	872	180	4.84	3.35
5.....	4	1,221	288	4.20	3.92
6.....	4	1,156	144	8.03	2.28
7.....	3	745	180	4.14	4.12
8.....	3	2,401	360	6.67	2.37
9.....	2	594	72	8.25	2.27
10.....	1	350	36	9.72	2.77
11.....	1	204	36	5.67	3.86
12.....	1	457	72	6.35	2.36

¹This cost includes potato puree at 15 cents per pound and the approximate cost of all the added material used in preparing the finished product.

cost decreased, Table 4. Schools 6, 9, and 10 were grammar schools and each obtained a rather large number of servings from each pound of puree used.

REACTIONS *to* FROZEN SWEETPOTATO PUREE

All cafeterias that tested the sweetpotato puree were highly favorable toward the product. A rating of good or excellent was given in 98 per cent of all instances in which various factors were evaluated, Table 5. There were no apparent differences between large, commercial cafeterias and school lunch cafeterias in their ratings of the product.

With regard to flavor, all replies were either excellent or good. In only one instance did color rate other than excellent or good. For fiber content, waste, and uniformity, almost all replies were excellent. Keeping quality was considered good to excellent by all but one cafeteria.

TABLE 5. EVALUATION OF FROZEN SWEETPOTATO PUREE CHARACTERISTICS BY 17 SELECTED COMMERCIAL AND SCHOOL CAFETERIAS¹

Factors evaluated	Evaluation			
	Excellent	Good	Fair	Poor
	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>
Flavor.....	11	6		
Texture.....	12	4	1	
Color.....	8	8		1 ²
Fiber content.....	15	2		
Ease of preparation.....	11	6		
Labor required in preparing.....	10	7		
Length of cooking time.....	8	9		
Yield.....	9	6		1 ³
Waste involved.....	16	1		
Uniformity in quality.....	15	1	1	
Keeping quality (refrigerated).....	11	6		
Keeping quality (frozen).....	13	4		

¹ The number in each column indicates the number of cafeterias rating the product as such.

² Reason given—too orange or yellow; should be brown.

³ Reason given—product too dense.

In three of the commercial cafeterias, table tents were provided indicating that the pie and soufflé were made from improved, experimental puree with an invitation to patrons to make comments voluntarily. A number of these comments were given. With only a few exceptions, comments were highly favorable.¹⁰

¹⁰ Of replies from 133 patrons, 96 per cent were favorable, 2 per cent were unfavorable, and 2 per cent were neither entirely favorable nor unfavorable.

PROBLEMS *in* HANDLING SWEETPOTATO PUREE

Commercial Cafeterias

Sweetpotatoes served as candied sweetpotatoes have long been a standard item for cafeteria use. Frozen puree cannot compete in this regard and many cafeterias will continue to prefer sweetpotatoes candied from fresh potatoes. This was indicated in preferences of cooperating cafeterias when asked to evaluate frozen puree in comparison with fresh and canned potatoes for their particular over-all use. One preferred the new product, 2 still preferred fresh potatoes, and 2 indicated they had no preferences. None of the cafeterias had used a frozen sweetpotato puree previously.

Although two cafeterias preferred fresh potatoes, they also indicated that they would purchase a frozen product of this type if it were on the market and priced to suit their use. Cost for preparing the product was thought to be relatively high by cafeterias 1, 2, and 4, but not excessive.

In evaluating the size of container best suited for frozen puree, no consistent size container was indicated. Recipes used and size of operation influenced the size of container listed as ideal for a product of this kind. Sizes preferred by the cafeterias were:

<i>Cafeteria number</i>	<i>Size of tin container preferred</i>
1	10 to 20 pounds
2	25 to 30 pounds
3	5 to 10 pounds
4	20 pounds
5	30 pounds

School Cafeterias

A very strong preference was expressed by school cafeterias for the frozen puree. All cafeterias expressed a preference for the puree over other forms of sweetpotatoes with reasons given being better texture, free of fiber, good color, ease of preparation, and fresh sweetpotato flavor. Three of the 12 cafeterias had used a canned product similar to the puree, but the remaining 9 had never used a similar product. Four different size containers were listed as being preferred by these cafeterias. Fifty-eight per cent preferred the 36-pound tin container because it furnished enough puree for one complete serving. Other desired sizes were 10-, 45- and 60-pound containers.

Eighty-three per cent of the school cafeterias had some kind of frozen storage space. Most of the frozen storage was regular deep-freeze space and did not provide space for excess storage. Two schools had ice cream boxes for storing frozen products. Sixty-seven per cent of the cafeterias thought the frozen puree easier to handle and less trouble to prepare than other forms of sweetpotatoes. Three cafeterias preferred canned sweetpotatoes and 1 had no preference for ease of handling.

SUMMARY

In evaluating the physical characteristics of frozen sweetpotato puree — a new product — 98 per cent of all the ratings given the product were either good or excellent by commercial and school cafeterias. The excellent rating was given more often than good.

Results indicate that the product was highly acceptable for preparing souffle and/or pie in 3 of the 5 commercial cafeterias that tested the product. While differences existed among cafeterias, patrons were almost as likely to select the improved sweetpotato product as those products with which it was in competition. All five cafeterias indicated they would purchase a product of this kind if it were on the market and priced to suit their use. Size of container listed as being most desirable for the product varied with the different recipes and the size of operation. A can size of 10 to 30 pounds appeared to be the most desirable.

All of the school cafeterias expressed a desire to purchase a product of this kind for use in preparing consumer products. Ease of preparation and the small amount of waste involved were thought to be the most outstanding features of the product by this group of cafeterias.

APPENDIX

Recipe Used by One Commercial Cafeteria

SWEETPOTATO PIE			
<i>Ingredients</i>	<i>Lb.</i>	<i>Oz.</i>	<i>Method</i>
Granulated sugar	2		
Salt		2	Sift together sugar, salt, flour, and
Cinnamon		1	cinnamon
Pastry flour		8	
Sweetpotato (puree)	13		Mix sweetpotato puree with sifted ingredients until well blended
White corn syrup	3		Add white syrup and mix well
Milk	4-6		Add milk until proper consistency is reached
			Allow mixture to stand ONE HOUR before adding eggs. It takes about this length of time for the proper absorption
Whole eggs	3		Whip whole eggs and add sweetpotato mixture mixing well
			While filling is being poured into shells, continue to stir balance of mix occasionally
			Bake 40 to 45 minutes at 400°; remove pies from oven just before they puff completely over the center
			YIELD: 13 to 14 pies