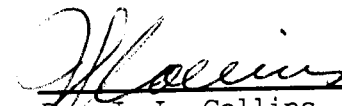
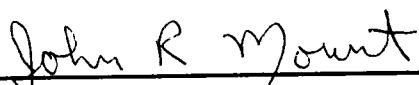
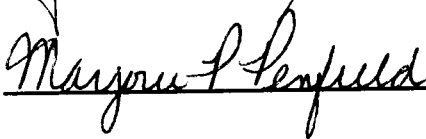


To the Graduate Council:

I am submitting herewith a thesis written by Jye-Yin Liao entitled "Chemical, Physical, and Sensory Attributes of Formed and Frozen Baked Sweet Potato." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Food Technology and Science.


Dr. J. L. Collins, Major Professor

We have read this thesis and
recommend its acceptance:

Accepted for the Council:


Associate Vice Chancellor
and Dean of The Graduate School

CHEMICAL, PHYSICAL, AND SENSORY ATTRIBUTES OF FORMED AND
FROZEN BAKED SWEET POTATO

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Jye-Yin Liao
December 1992

DEDICATION

This thesis is dedicated to my parents Ren-Sheu
Liow and Chieh-Yu Wang, my brothers, Jeh-San
Liow and Jye-Fu Liow, and to their families for
their support and love.

ACKNOWLEDGMENTS

The author thanks Dr. Jim L. Collins for his patience, guidance, encouragement, and understanding throughout completion of this thesis. Appreciation is extended to Dr. John R. Mount and Dr. Marjorie P. Penfield, committee members, for guidance, advice and assistance throughout the research and to Dr. David Coffey for assistance in growing the sweet potato at the Plant Sciences Field Laboratory, The University of Tennessee, Knoxville.

A special thanks is extended to Ms. A. Ruth Hill and Mr. Ming-Cheng J. Chang for their assistance and friendship during the program and to all sensory panelists for their attendance and patience.

A special thanks is extended to the faculty and staff of the Department of Food Technology and Science, The University of Tennessee, for academic assistance and friendship and to The Tennessee Agriculture Experiment Station for its financial support.

A special thanks is extended also to Viskase Co., for supplying cellulose casing which were used in package.

Last, but not least, the author expresses her deepest love and appreciation to her parents, Chieh-Yu and Ren-Sheu Liao, her brothers Jeh-San Liow and Jye-Fu Liow and to their families for their love and encouragement during her college career and also to brothers and sisters of Knoxville Chinese Christian Church for their love, prayers, and encouragement.

ABSTRACT

The objectives of this experiment were to prepare a convenience-type product by stuffing pieces of baked sweet potato (SP) into cellulose casing followed by freezing and to determine some chemical, physical, and sensory attributes of the product.

A precooked, frozen sweet potato (SP) product was prepared from cured, stored roots of orange-colored cultivars, Southern Delight and W-241. The roots were prepared by baking at 190°C for 75-90 min or 204°C for 70-80 min, peeling and cutting into pieces. The pieces were encased in a cellulose casing, quick frozen at -34°C, and stored at -17°C for 0, 2, and 6 mo.

From frozen storage, samples were thawed and tested for proximate analysis, color, and β -carotene. Samples were heated and evaluated by a sensory panel, using an 8-point hedonic scale and a 6-point purchase intent (FACT) scale.

All measurements were affected by cultivar; baking and storage had no effect on test measurements except for Hunter color values and retinol equivalents (RE). In some cases, interactions of the main factors were significant. 'Southern Delight' contained higher amounts of moisture and nitrogen-free extract, but lower amounts of crude protein, crude fat, and ash.

'W-241' and all products stored 6 mo had more intensive color and also 2.2% greater amount of RE than 'Southern Delight.' For the effects of baking x storage interaction, products stored 1 da and 6 mo after being baked at 204°C contained higher amounts of RE.

Panelists preferred the 'W-241' product and scored it as 'like moderately' and would more likely purchase it than 'Southern Delight.' Baking only affected the color acceptability. SP product baked at 190°C/75-90 min and stored 6 mo and product baked at 204°C/70-80 min and stored 2 mo had more acceptable color. Product stored 6 mo received higher flavor acceptability scores than product stored 2 mo, and would have been purchased over product stored 2 mo except for the third replication. Product baked at 190°C/75-90 min and stored 6 mo also would have been purchased over product baked at 190°C/75-90 min and stored 2 mo. The storage and replication interaction was significant for color, texture, and overall acceptabilities

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CHAPTER I

INTRODUCTION

Sweet potato (SP) (*Ipomoea batatas* Lam.) is an important crop in the southern United States, including Tennessee (USDA, 1991). It is a nutritious food, being rich in β -carotene, vitamin C, dietary fiber, complex carbohydrates, and certain minerals (NAS, 1989; Picha, 1985; USDA, 1984). Although the SP is nutritious, its consumption is low due to the absence of ready-to-serve products. Successful products of today should possess characteristics that allow for convenience in preparation for serving and eating.

One traditional method of cooking SP is baking. This method, however, requires the availability of suitable raw roots, time, and effort of baking. If a baked product was available that could be preserved by freezing and heated at the time of consumption, then SP might be consumed more often.

The objectives of this experiment were to prepare a convenience-type product by stuffing pieces of baked sweet potato into cellulose casing and freezing and to determine selected chemical, physical, and sensory attributes of the product.

CHAPTER II

REVIEW OF LITERATURE

A. History and Physiology of Sweet Potato

Sweet potato (SP) (*Ipomoea batatas* Lam.), member of the morning glory family, is an important food crop (Metcalf, 1980; Rehm and Espig, 1991; Robbins, 1931). Originally, SP was grown in Central America, Mexico, and Colombia where it was discovered and taken to Western Europe by the Spanish in late fifteenth century (Yen, 1982). From there, it was taken to many areas such as Africa and China (Yen, 1982). SP was introduced into the United States and was first planted in Virginia in 1648 (Martin and Leonard, 1967). It was one of the major food crops in the United States at the beginning of twentieth century with per capita consumption of 14.3 kg in 1917 which has decreased to 1.9 kg in 1989 (USDA, 1944; 1990).

SP is a perennial plant with large storage roots and is grown as an annual crop in the United States. It is planted widely around the world, from tropical and subtropical to temperate zones. Areas include China, India, the greater Pacific area, Latin America, Africa, southern United States and California, Australia, and New Zealand (Bouwkamp, 1985; Edmond and Ammerman, 1971; Litzberger, 1974; Martin, 1984; Robbins, 1931).

B. Production of Sweet Potato

SP is an important starchy root crop with total production in Asia and Africa alone of over 90% of the world's production (FAO,

1990). In the United States, production has declined over the past 20 years (USDA, 1990). However, it is still an important food crop in North Carolina, Louisiana, California, Texas, and most southern states. SP are classified into 2 types: dry and moist. These are characterized, not according to the moisture content, but to their texture after baking (Fitzgerald, 1976; S-101 Technical Committee, 1980). The dry-type has a firm and mealy texture with a less sweet taste. The moist-type remains soft with a sweeter taste and is more acceptable to most consumers (Bouwkamp, 1985; S-101 Technical Committee, 1980; Walter et al., 1975).

C. Nutritional Value of Sweet Potato

SP is a nutritive vegetable with considerable amounts of complex carbohydrates, vitamins, minerals, and dietary fiber. On average, 100 g SP contains 72.84 g water, 24.28 g carbohydrate, 1.65 g protein, 0.30 g fat, 0.85 g fiber, and 0.95 g ash and provides 105 Kcal (439 kJ) or 5% of the energy allowance for an adult (NAS, 1989; USDA, 1984).

SP is exceptionally rich in pro-vitamin A with 2,006 retinol equivalents (RE)/100 g which is about twice the Recommended Dietary Allowance (RDA) for an adult man and two and one-half times that for an adult woman (USDA, 1984). This amount of SP also provides a considerable amount of vitamin C (22.7 mg/100 g), about one-third the RDA requirement, in addition to thiamin (0.066 mg/100 g), riboflavin (0.147 mg/100 g), niacin (0.674 mg/100 g), and pantothenic acid (0.591 mg/100 g) (USDA, 1984).

Potassium (204 mg/100 g) is the predominant mineral present in SP (USDA, 1984). Calcium (22 mg/100 g), iron (0.59 mg/100 g), magnesium (10 mg/100 g), and phosphorous (28 mg/100 g) each provides about 2.75%-3.5% of the RDA requirement for an adult person (USDA, 1984).

D. Sweet Potato Products

In the United States, about 60-70% of the SP crop is consumed as human food in the form of fresh roots or as canned, dehydrated, or frozen products.

1. Canned

Presently, SP may be canned as regular, vacuum, or solid packing (CFR, 1991). Vacuum packs contain no packing medium. Whole, halves, sections, pieces, whole and pieces and mixed, except mashed, styles may be canned in the regular and vacuum packs. Currently, this product is distributed widely and consumed over the United States (Law, 1977).

2. Flakes

Deobald and McLemore (1962) developed precooked dehydrated SP flakes which were made from cured, stored roots. With proper packaging the product has a very stable shelf life. They also found that the quality and drying characteristics of flakes could be improved by preheating the whole, unpeeled roots under certain conditions. Hoover (1966) successfully developed a procedure for manufacturing precooked dehydrated SP flakes from fresh, uncured roots by the controlled addition of amylolytic enzymes to the puree before drying. Later, an "enzyme activation" technique for producing SP flakes from freshly harvested or cured, stored roots was described

by Hoover (1967). A preheat treatment was used to hydrolyze starch by using the native enzyme system in the SP. This new technique produced high quality SP flakes without adding saccharifying enzyme from a commercial source.

3. French-fry-type product

Preparation of high quality deep-fat fried products from SP has been reported by many researchers (Hoover and Miller, 1973; Kelley et al., 1958; Olorunda and Kitson, 1977; Sistrunk et al., 1954; Walter and Hoover, 1986). The main problem of producing SP chips and frozen french fries is discoloration which is considered to be related to the sugar content of SP (Olorunda and Kitson, 1977; Picha, 1986). Potato (*Solanum tuberosum* L.), with over 0.5% reducing sugar, is unsuitable for producing high quality potato chips (Hoover and Miller, 1973). SP usually contains over 2% reducing sugar after curing and storage for several months (Hoover and Harmon, 1967; Walter and Hoover, 1984). Kelley et al. (1958) reported that sugar content of SP decreased after storage at 30°C for several wk before processing. They also successfully used eastern (dry-type) SP to produce chips, strips, dice, and frozen french fries without prior blanching or soaking. Hoover (1963) found that a 0.3-0.4% sodium acid pyrophosphate (SAPP) or a 3:1 mixture of SAPP and tetrasodium pyrophosphate to SP puree added before drying could control discoloration. Hoover and Miller (1973) produced a pleasant colored SP chip by dipping raw roots into SAPP at levels between 0.5 and 1.0% prior to blanching. Since discoloration is due to the sugar content, Hannigan (1979) indicated that treatment of SP slices with a

diffuser-extractor lowered the sugar content of slices prior to frying, thus enabling production of fried chips without the dark color.

4. Precooked, frozen product

Usually, SP production is abundant from September to November. Quality of fresh roots gradually declines throughout the winter months. Although the roots can be cured and stored in storage facilities with controlled temperatures and humidity until spring and summer, they are not readily available for producing excellent quality products (Woodroof and Atkinson, 1944). Fitzgerald and Fellers (1938) indicated that some processed vegetables and fruits stored at low temperature in an impervious package could retain almost all their vitamin A potential until delivery to consumers. Hoover and Stout (1956) discussed a procedure to produce superior quality SP products from precooked and frozen SP for year-round consumption. However, 35% of the firmness of SP would be lost by freezing and thawing. Acceptable quality SP patties have been produced for several years from freshly harvested roots (Kimbrough and Kimbrough, 1961). Later, Hoover et al. (1983) developed a method for producing a satisfactory quality patty from cured, stored SP of 'Jewel' and 'Centennial.' Sensory evaluation showed that acceptable patties could be prepared either from fresh or cured roots when stored up to 6 mo. This product was acceptable to consumers.

Collins et al. (1976) evaluated frozen products prepared from cured, baked roots. They added raisins, pork, pineapple or flavorings of pineapple or orange to mashed SP. This product needed

only a short period of heating before serving. Sensory panelists indicated that the products were highly acceptable.

Wu et al. (1991) investigated the shelf stability of baked whole SP during frozen storage and evaluated acceptability of microwave heating. Results indicated that quality of the product was stable during 6 mo of frozen storage, except for vitamin C which decreased approximate 50% during the first month of storage. Sensory scores showed that baked SP from all treatments were acceptable.

5. Other products

A 'fruit leather' product prepared from cured, baked SP and other ingredients was produced by Collins and Washam-Hutsell (1987). The product contained 5.9% moisture, 5.8% crude protein, 4.9% crude fat, 4.9% ash, 2.2% crude fiber, and 84.8% nitrogen-free extract. Dietary fiber content was 4.1% and provided 17.3 kJ/g.

E. Quality of Baked Sweet Potato

The quality of baked SP consists of a set of complicated characteristics: sweetness, fiber content, moistness, color, flavor, texture, and personal preference. Some of these characteristics may be analyzed by instrumentation, but, at present, sensory evaluation is the most acceptable method to determine quality (Rao et al., 1975).

Normally, baked SP of the highest quality has droplets of dark-colored syrup on the skin surface, deep orange colored flesh, and soft, moist, sweet mouthfeel/taste (S-101 Technical Committee, 1980). The most desirable baked SP may have a relative high dietary fiber content.

F. Advantages of Baking

Baked SP is a popular form of SP in the United States because it tastes sweet and possesses moist mouthfeel. Several reports indicated that baked SP retained nutritional value and possessed excellent quality to a greater extent than boiled and steamed SP (Collins, 1981; Picha, 1985; Sistrunk, 1977).

Reddy and Sistrunk (1980) reported that baked roots displayed considerable changes in carbohydrates. Baked roots, as compared to boiled or steamed roots, had the highest content of total and reducing sugars (Bradbury et al., 1988; Sistrunk et al., 1954). Sistrunk (1977) indicated that baked roots had a brighter and more orange color than boiled roots. The dry matter content of baked SP was also higher than that of boiled (Sistrunk, 1977). Martin (1986) reported that carbohydrate content of SP influenced taste and mouthfeel. Purcell and Walter (1988) investigated the carbohydrate content in baked SP between convection heating and microwave heating. Roots baked by microwaves contained less soluble carbohydrates and had a drier mouthfeel. Because the roots were heated rapidly, amylolytic enzymes were denatured before significant starch hydrolysis and accompanying softening could occur.

CHAPTER III

MATERIALS AND METHODS

A. Source of Sweet Potato

Two cultivars of sweet potato (SP) (*Ipomoea batatas* Lam.), Southern Delight and W-241, were grown at the Plant and Soil Science (PSS) Field Laboratory, The University of Tennessee, Knoxville, harvested and cured at 30°C and 80-90% relative humidity for 10 da (Walter and Hoover, 1984) by personnel of PSS. The roots were transported to the Food Science and Technology Department, The University of Tennessee, and stored at 14°C for 4 mo.

B. Preparation of Sweet Potato

Roots were washed in tap water to remove soil and dried. Dry roots were baked to eating doneness (100°C at the center of SP), in a preheated Despatch oven supplied by Despatch Ovens Co. (Minneapolis, MN) at 190°C for 75-90 min or 204°C for 70-80 min; time depended on size. Central temperature of SP was measured by a Thermocouple digital thermometer (Model 14325; Atkins Technical Inc., Gainesville, FL). After baking, the peel was removed by hand and the cooled flesh was sliced into pieces (2.5 x 2.0 x 1.5 cm). Pieces were extruded into a cellulose casing (42.6 mm diameter when filled) supplied by Viskase Co. (Chicago, IL). The extruder was a Frey Electro-Hydraulic Stuffer (Koch Supplies Inc., Kansas City, MO). The filled casing was tied-off in 20-cm sections. The "log" was wrapped with plastic film and frozen in an air-blast freezer at -34°C for a day and then held at -17°C for 2 and 6 mo.

C. Proximate Analysis

1. Moisture

Moisture content was determined according to the AOAC Vacuum Oven method 14.003 (AOAC, 1990). Thawed samples (2 g) were dried in a vacuum oven at 70°C at 175 mm Hg for 16 hr.

2. Preparation of Sample

Samples (200 g) of frozen, baked SP were thawed 24 hr in a refrigerator and dried in a cabinet dehydrator for 3-4 da. Dried samples were ground in a Wiley Mill (Intermediate Model, Macalaster Bicknell Co., New Haven, CT) to pass through a 30-mesh sieve. Ground samples were placed in closed glass jars over desiccant at room temperature and held for proximate analysis within 1 da after preparation and after 2 and 6 mo when held at -17°C. Tests were conducted in triplicate. All data were measured and calculated on dry weight basis (DWB).

3. Crude Protein

Nitrogen was determined by the AOAC Kjeldahl method 7.021 (AOAC, 1990). Dry samples (1 g) were analyzed. Percentage of crude protein was calculated by multiplying percentage of nitrogen x 6.25.

4. Crude Fat

Dry samples (2 g) were extracted 5 hr with petroleum ether in a Goldfish apparatus according to AOAC method 7.062 (AOAC, 1990). Percentage of total lipid content was calculated.

5. Total Dietary Fiber

Dry samples (1 g) were analyzed in duplicate by using the enzymatic-gravimetric method of Prosky et al. (1988).

6. Ash

Ash was measured by the AOAC Dry Ashing method 7.009 (AOAC, 1990). Dry samples (2 g) were ashed in a Muffle Furnace at 600°C for 2 hr. Percentage of ash was calculated.

7. Nitrogen-free extract

Percentage of nitrogen-free extract was calculated by subtracting the percentage of crude protein, crude fat, total dietary fiber, and ash from 100%.

D. Measurement of Color

Color of baked SP was measured with the Hunter Color Difference Meter (Model D25D2M) which was standardized with an orange tile: $L=58.9$, $'a'=27.9$, and $'b'=31.8$ (Lanier and Sistrunk, 1979). Samples were thawed and mixed in an Osterizer (Oster Corporation, Milwaukee, WI). Then, they were held in a cuvette with an optical glass bottom for measurement.

E. β -carotene Determination

1. Sample preparation

Fifty-gram samples of baked, frozen SP were thawed overnight in a refrigerator and freeze-dried in a Virtis UE800 Freeze-Dryer (The Virtis Co., Gardiner, NY). Dried samples were ground in a Wiley Mill (Intermediate Model, Macalaster Bicknell Co., New-Haven, CT) to pass through a 30-mesh sieve. Ground samples were placed in closed glass jars over desiccant at ambient temperature and held for analysis.

2. β -carotene measurement

β -carotene was determined by the method of Cort as cited by Holden (1985), using High Performance Liquid Chromatography (HPLC). One-gram dry SP samples were extracted with HPLC-grade hexane for 4 hr. The extract was diluted to 100 mL and filtered through the 0.45- μ m acrodisc filter (Gelman Science, Ann Arbor, MI). After filtration, 20 μ L were injected in triplicates into the HPLC system.

The HPLC unit was equipped with model 6000A solvent delivery system, model U6K injector, μ Proasil silica C-10 (3.9 x 300 mm dimension) column, Lambda-max Model 480 LC Spectrophotometer absorbance detector at 452 nm (Waters Association, Milford, MA), CR501 Chromatoac, 2-channel data process recorder (Shimadzu Corp., Kyoto, Japan). The mobile phase was a mixture of HPLC-grade hexane/acetone (85/15, v/v) which was filtered through a 0.45- μ m Nylaflo Nylon Disc (Gelman Science, Ann Arbor, MI) before use. The flow rate was 2 mL/min.

A standard solution of β -carotene, 0.003 mg/mL, was prepared and filtered through the 0.45- μ m filter. Standardized solutions of 5, 10, and 25 μ L were injected in duplicate into the HPLC to establish reference points. The standard curve of peak area versus concentration of β -carotene was determined by the HPLC external standard method (Smith and Stewart, 1981). β -carotene values were converted to retinol equivalents (RE) of vitamin A by the formula: 6 μ g β -carotene = 1 RE vitamin A (NAS, 1989).

F. Sensory Evaluation

Baked SP samples from -17°C storage for 2 and 6 mo were evaluated by a sensory panel. Frozen samples (19 mm) were heated in a microwave oven (Model KM540G; 750 Watt; White-Westinghouse Appliance Co., Pittsburgh, PA) for 4 min on full power before serving. Testing was conducted using 30 untrained panelists. Samples were evaluated in a laboratory designed for sensory evaluation and samples were served in randomized order and illuminated with the white fluorescent lighting (IFT, 1971; Penfield, 1990). Each panelist received 1 sample (1/4 of a whole piece) at a time. Samples were presented in random order and coded with 3-digit random numbers. Three samples were evaluated not tasted due to coliform contamination. Reheated, baked SP samples were evaluated on 3 separate da on an 8-point hedonic scale (Larmond, 1977; Penfield, 1990) for color, flavor, texture and overall acceptabilities and a 6-point FACT scale (Penfield, 1990; Schutz, 1965) for the potential for purchasing the products (Appendix A). Panelists were instructed to rinse their mouths between samples.

G. Experimental Design

Proximate analysis, β -carotene, and Hunter color measurements were arranged as factorials of a completely randomized block design ($2 \times 2 \times 3$; cultivar $\times$ baking condition $\times$ storage time) (Ott, 1988). The experiment was replicated 3 times. Data were analyzed by the Analysis of Variance procedure (ANOVA) (SAS Institute Inc., 1985). All non-significant ($p > 0.05$) interactions were removed after the first statistical analysis (Appendix B and C), and the data were

reanalyzed. Significance among means was determined by Tukey's Test when appropriate (Linton et al., 1975; SAS Institute Inc., 1985).

Sensory data were analyzed as factorials of a randomized incomplete block design due to missing data, because a total of 6 samples at 2 storage periods contained over 10 coliform forming units/gram (CFU/g) (Appendix D). Those which were contaminated were not tasted by panelists. Factors were 3 replications, 2 cultivars, 2 baking conditions, and 2 storage times. Data were analyzed by the General Linear Model (GLM). After initial analysis, non-significant ($p>0.05$) interactions were removed from the model (Appendix E), and the data were reanalyzed. Significant differences by the Least-squares Means method were determined with the pdiff option (SAS Institute Inc., 1985). In cases where GLM did not estimate the means, a one-way ANOVA of the data was used and when appropriate means were separated by the Tukey's Test. Means of the actual data of significant interactions were plotted.

CHAPTER IV

RESULT AND DISCUSSION

A. Proximate Analysis

The F-values from the ANOVA of the proximate analysis of the baked, frozen SP product indicated that cultivar had the greatest effect on composition (Table 1). All measurements except total dietary fiber were affected ($p < 0.01$) by cultivar. Moisture was affected by the cultivar x storage interaction ($p < 0.01$). Replication was significant ($p < 0.05$) for crude fat.

'Southern Delight' products contained greater amounts of moisture and nitrogen-free extract (NFE), but lower amount of crude fat, crude protein, and ash than 'W-241' products (Table 2). That was in agreement with the results indicated by Collins (1981). That report presented differences in fat, protein, ash, and carbohydrate content of canned SP, not only among cultivars, but within cultivars to greater extent. Splittstoesser (1977) and Purcell et al. (1972) reported protein content of SP from 1.7 to 11.8% (DWB), depending on cultivar and growth conditions. Purcell et al. (1976) later reported that protein content was dependant on the cultivar of SP.

Mean values for moisture of the baked, frozen SP product as affected by the cultivar x storage interaction are presented in Table 3. No differences occurred among storage periods within cultivar, but the means for 'W-241' were lower ($p < 0.01$) than those for 'Southern Delight.' As a single variable, cultivar had the greater effect; this influence was evident also in the interaction.

Table 1 - F-values from Analysis of Variance of proximate analysis of baked, frozen sweet potato product

	df	Moisture	Attributes of solids				
			Crude fat	Crude protein	TDF ^a	Ash	NFE ^a
Cultivar (C) ^b	1	5,348.53**	3,096.60**	919.16**	0.21	154.10**	66.50**
Baking (B) ^c	1	4.20	1.74	0.63	3.13	2.38	3.32
Storage (S) ^d	2	1.95	1.00	1.31	1.00	0.70	1.26
Replication (R)	2	0.54	3.88*	0.08	1.61	1.23	1.55
CxS	2	6.51**					
Error	29	-	-	-	-	-	-

* $p < 0.05$.

** $p < 0.01$.

^a TDF = total dietary fiber; NFE = nitrogen-free extract.

^b Cultivars were Southern Delight and W-241.

^c Conditions for baking were 190°C for 75-90 min and 204°C for 70-80 min.

^d Storage periods were 0, 2, and 6 mo.

Table 2 - Mean values of proximate analysis of baked, frozen sweet potato product as affected by cultivar, baking, and storage

		Attributes of solids				
Factor	Moisture	Crude fat	Crude protein	TDF ^a	Ash	NFE ^a
-----% (DWB) ^b -----						
Cultivar						
Southern Delight	72.55 ^X	0.93 ^Y	7.93 ^Y	10.93 ^C	5.24 ^Y	75.02 ^X
W-241	71.72 ^Y	1.09 ^X	8.06 ^X	10.91 ^C	5.33 ^X	74.57 ^Y
Baking (°C/min)						
190/75-90	72.12 ^C	1.01 ^C	7.99 ^C	10.87 ^C	5.28 ^C	74.84 ^C
204/70-80	72.15 ^C	1.01 ^C	7.99 ^C	10.97 ^C	5.29 ^C	74.74 ^C
Storage (mo)						
0	72.13 ^C	1.01 ^C	7.99 ^C	10.90 ^C	5.29 ^C	74.81 ^C
2	72.12 ^C	1.01 ^C	7.99 ^C	10.87 ^C	5.28 ^C	74.83 ^C
6	72.15 ^C	1.01 ^C	7.99 ^C	10.97 ^C	5.29 ^C	74.73 ^C

N = 18 for Southern Delight and W-241 and for 190°C/75-90 min and 204°C/70-80 min; 12 for 0, 2, and 6 mo.

^a TDF = total dietary fiber; NFE = nitrogen-free extract.

^b DWB = dry weight basis.

^c Means in a column within a factor are not different (p>0.05).

^{x,y} Means in a column within a factor not sharing same superscript are different (p<0.01).

Table 3 - Mean values of moisture of baked, frozen sweet potato product as affected by cultivar x storage interaction

Cultivar	Storage (mo)	Moisture (%)
Southern Delight	0	72.53 ^x
	2	72.57 ^x
	6	72.55 ^x
W-241	0	71.74 ^y
	2	71.68 ^y
	6	71.75 ^y

N = 6 for all means.

^{x,y} Means in a column not sharing same superscript are different (p<0.01).

B. Hunter Color Measurement

Hunter color measurements were affected ($p < 0.01$) by some of the factors investigated (Table 4). Hunter L (lightness) was affected by cultivar. Hunter 'a' (redness) and 'b' (yellowness) were affected by cultivar and storage ($p < 0.01$).

Products of both cultivars were an orange color as indicated by similar, relatively high 'a' and 'b' values. 'W-241' exhibited higher values than 'Southern Delight' for each color attribute (Table 5). No significant differences occurred between L, 'a' and 'b' values of the products baked for 190°C/75-90min or 204°C/70-80min. Product stored 6 mo showed no differences in L values, but 'a' values increased at 2 mo and decreased at 6 mo storage; 'b' values decreased as storage periods were extended.

This finding was in agreement with the results reported by Wu et al. (1991). They found CIE luminosity values of baked, frozen SP after 1, 3, and 6 mo storage were not significantly different. The 'a' values (redness) showed no consistent change with respect to frozen storage and also remained stable after 6 mo storage. The decrease in 'b' values (yellowness) indicated a reduction of yellow color.

C. Retinol Equivalents

The β -carotene content and retinol equivalents (RE) (Table 6) were affected by cultivar and baking ($p < 0.01$) and the baking x storage interaction ($p < 0.01$). 'W-241' contained 2.2% more β -carotene and RE than 'Southern Delight' (Table 7). Differences in total

Table 4 - F-values from Analysis of Variance of Hunter color measurements of baked, frozen sweet potato product

Factor	df	Color		
		L	'a'	'b'
Cultivar (C) ^a	1	1,706.46**	103.98**	82.21**
Baking (B) ^b	1	3.34	0.94	1.22
Storage (S) ^c	2	0.40	22.87**	19.41**
Replication	2	2.81	0.24	0.34
Error	29	-	-	-

** $p < 0.01$.

a Cultivars were Southern Delight and W-241.

b Conditions for baking were 190°C for 75-90 min and 204°C for 70-80 min.

c Storage periods were 0, 2, and 6 mo.

Table 5 - Mean values of Hunter color measurements of baked, frozen sweet potato product as affected by cultivar, baking, and storage

Factor	Color ^a		
	L	'a'	'b'
Cultivar			
Southern Delight	43.6 ^Y	24.3 ^Y	26.1 ^Y
W-241	44.2 ^X	24.6 ^X	26.3 ^X
Baking (°C/min)			
190/75-90	43.9 ^b	24.4 ^b	26.2 ^b
204/70-80	43.9 ^b	24.4 ^b	26.2 ^b
Storage (mo)			
0	43.9 ^b	24.4 ^Y	26.3 ^X
2	43.9 ^b	24.6 ^X	26.2 ^Y
6	43.9 ^b	24.4 ^Y	26.1 ^Z

N = 18 for Southern Delight and W-241 and for 190°C/75-90 min and 204°C/70-80 min; 12 for 0, 2, and 6 mo.

a L = lightness (0 = black, 100 = pure white); 'a' and 'b' = redness and yellowness, respectively, and color intensity increased as the value increased.

b Means in a column within a factor sharing same superscript are not different ($p > 0.05$).

x-z Means in a column within a factor not sharing same superscript are different ($p < 0.01$).

Table 6 - F-values from Analysis of Variance of β -carotene and retinol equivalents (RE) of baked, frozen sweet potato product

Factor	df	β -carotene	RE
Cultivar (C) ^a	1	44.27**	44.56**
Baking (B) ^b	1	51.80**	51.86**
Storage (S) ^c	2	0.93	0.92
Replication	2	1.01	1.02
B x S	2	16.76**	16.88**
Error	27	-	-

** $p < 0.01$.

a Cultivars were Southern Delight and W-241.

b Conditions for baking were 190°C for 75-90 min and 204°C for 70-80 min.

c Storage periods were 0, 2, and 6 mo.

Table 7 - Mean values of β -carotene and retinol equivalents (RE) of baked, frozen sweet potato product as affected by cultivar, baking, and storage

Factor	β -carotene (mg/100 g)	RE/100 g
	-----DWB ^a -----	
Cultivar		
Southern Delight	47.41 ^Y	7901 ^Y
W-241	48.46 ^X	8076 ^X
Baking ($^{\circ}$ C/min)		
190/75-90	47.37 ^Y	7894 ^Y
204/70-80	48.50 ^X	8083 ^X
Storage (mo)		
0	48.08 ^b	8012 ^b
2	47.90 ^b	7983 ^b
6	49.82 ^b	7970 ^b

N = 18 for Southern Delight and W-241 and for 190 $^{\circ}$ C/75-90 min and 204 $^{\circ}$ C/70-80 min; 12 for 0, 2, and 6 mo.

a DWB = dry weight basis.

b Means in a column within a factor are not different ($p > 0.05$).

x,y Means in a column within a factor not sharing same superscript are different ($p < 0.01$).

carotenoids within cultivars were reported also by Miller and Covington (1942) and Reddy and Sistrunk (1980). Both groups of researchers indicated that the amount of total carotenoids in SP depended upon cultivar. Ezell and Wilcox (1946) also found that carotene and total carotenoid content varied more than 400% within every cultivar. Therefore, in order to obtain the highest levels of carotene and consequently the highest levels of vitamin A activity during processing, choice of cultivar is an important factor.

β -carotene, of all major carotenoids, provides the greatest amount of vitamin A (Purcell, 1962; Purcell and Walter, 1968). Current recommended RE for an adult male is 1,000/da and for an adult female, 800/da (NAS, 1989). Therefore, 100 g baked, frozen SP product can supply at least 7 times the daily requirement of vitamin A for an adult male and about 10 times for an adult female.

The product baked at 190°C had 2.2% less RE as compared to the product baked at 204°C (Table 7), probably because the longer cooking time caused greater β -carotene loss. β -carotene in foods is very sensitive to oxidation decomposition when exposed to air, and rate of oxidation can be increased in the presence of light, heat, and certain catalysts such as metals.

Table 8 presents results of the baking x storage interaction for β -carotene and RE. No changes occurred during storage of the product baked at 190°C or 204°C. However, product stored 1 da (0 mo) after being baked at 204°C contained 5.1% greater amount of β -carotene and RE than product stored 1 da (0 mo) after being baked at 190°C.

Table 8 - Mean values of β -carotene and retinol equivalents (RE) of baked, frozen sweet potato product as affected by baking x storage interaction

Baking ($^{\circ}$ C/min)	Storage (mo)	β -carotene (mg/100 g)	RE/100 g
		-----DWB ^a -----	
190/75-90	0	46.89Y	7814Y
	2	47.49 ^{XY}	7965 ^{XY}
	6	47.43Y	7904Y
204/70-80	0	49.27 ^X	8211 ^X
	2	48.02 ^{XY}	8002 ^{XY}
	6	48.21 ^{XY}	8035 ^{XY}

N = 6 for all means.

^a DWB = dry weight basis.

^{X,Y} Means in a column not sharing same superscript are different ($p < 0.01$).

D. Sensory Evaluation

Sensory evaluation of the heated SP product previously held in frozen storage determined that several factors influenced ($p < 0.05$) the measurements (Table 9). Color acceptability was affected by cultivar and baking and the baking x storage, baking x replication, and storage x replication interactions. Flavor acceptability was affected by cultivar and storage. Texture acceptability was affected by cultivar and the cultivar x replication and storage x replication interactions. Overall acceptability was affected by cultivar and the storage x replication interaction. The potential for purchasing SP product was affected by cultivar and storage and the baking x storage and storage x replication interactions. Scores for all factors differed ($p < 0.05$) among panelists within storage, and scores for color, texture, and overall acceptabilities differed ($p < 0.05$) among replications.

All acceptability scores of 'W-241' were greater ($p < 0.05$) than those of 'Southern Delight' (Table 10). On average, 'W-241' product was considered as 'like moderately' to midway between this category and the 'like very much' category. 'Southern Delight' product was considered in the 'like slightly' category. Panelists would purchase 'W-241' over 'Southern Delight.' The difference between cultivars was the most important factor affecting acceptability of the product. A similar result was also found between 'Porto Rico' and 'Allgold' cultivars (Jenkin and Gieger, 1957). 'Allgold' baked after 7 wk storage had finer texture and

Table 9 - F-values from General Linear Model of acceptability and potential for purchasing scores assigned to baked, frozen sweet potato product

Factor	df	Acceptability				Potential for purchasing
		Color	Flavor	Texture	Overall	
Cultivar (C) ^a	1	159.85*	14.52*	86.01*	92.18*	56.38*
Baking (B) ^b	1	8.83*	0.37	0.17	0.08	0.14
Storage (S) ^c	1	0.17	5.00*	2.31	2.55	12.79*
Panelist (Storage)	57	5.96*	5.36*	5.50*	4.97*	7.56*
Replication (R)	2	4.53*	0.72	3.72*	3.48*	2.45
C x R	2			8.43*		
B x S	1	12.04*				5.51*
B x R	2	3.08*				
S x R	2	7.62*		4.96*	6.34*	6.38*
Error	39	-	-	-	-	-

* $p < 0.05$.

^a Cultivars were Southern Delight and W-241.

^b Conditions for baking were 190°C for 75-90 min and 204°C for 70-80 min.

^c Storage periods were 2 and 6 mo.

Table 10 - Least-squares mean sensory scores of acceptability and potential for purchasing of baked, frozen sweet potato product as affected by cultivar, baking, and storage with exception that texture means are arithmetic means

Factor	Acceptability ^a				Potential for purchasing ^b
	Color	Flavor	Texture	Overall	
Cultivar					
Southern Delight	5.2 ^d	5.3 ^d	5.1 ^d	4.9 ^d	3.1 ^d
W-241	6.6 ^C	5.8 ^C	6.2 ^C	6.0 ^C	3.8 ^C
Baking (°C/min)					
190/75-90	5.7 ^d	5.6 ^C	5.8 ^C	5.5 ^C	3.4 ^C
204/70-80	6.0 ^C	5.5 ^C	5.6 ^C	5.5 ^C	3.4 ^C
Storage (mo)					
2	5.9 ^C	5.4 ^d	5.7 ^C	5.4 ^C	3.3 ^d
6	5.9 ^C	5.7 ^C	5.8 ^C	5.6 ^C	3.6 ^C

N = 44 panelists across 2 cultivars, 2 baking condition, and 2 storage peroids.

a 1 = dislike extremely; 4 = dislike slightly; 5 = like slightly; 6 = like moderately; 7 = like very much; 8 = like extremely.

b 1 = I would never buy this; 2 = I would buy this hardly ever; 3 = I do not like this but would buy it occasionally; 4 = I like this and would buy it now and then; 5 = I would buy it frequently; 6 = I would buy this very often.

c,d Means in a column within a factor not sharing same superscript are different ($p < 0.05$).

moister taste than 'Porto Rico'; however, 'Porto Rico' baked after 14 wk had finer texture and moister taste than 'Allgold.'

Baking conditions only affected color acceptability. SP product baked at 204°C/70-80 min and stored 2 mo had more acceptable color than product baked at 190°C/75-90 min (Table 11).

Flavor acceptability and potential for purchasing were affected by storage periods. Product stored 6 mo had higher scores for flavor acceptability than product stored 2 mo (Table 10). SP product baked at 190°C/75-90 min and stored 6 mo would have been purchased over product baked 190°C/75-90 min and stored 2 mo (Table 11). This finding is similar to the results reported by Collins (1976). He reported that a frozen, flavored SP product was preferred more after 90 and 135 da than after 45 da. Preference was based on sample appearance, color, flavor, and texture.

Table 12 presents least-squares mean sensory scores of color, flavor, texture, and overall acceptabilities and potential for purchasing of baked, frozen sweet potato product as affected by specified interactions of experimental factors. The least-squares means were estimated because of missing data; some samples were not analyzed due to microbiological contamination. Graphic presentations of actual means may be found in Appendix F (Figure F.1-6). The texture acceptability data for the cultivar x replication were presented but only 2 replications were available for 'Southern Delight.' Texture scores for the storage x replication interaction could not be estimated by the least-squares procedure, probably due to the extent of missing data. The variation among the three

Table 11 - Least-squares mean sensory scores of color acceptability and potential for purchasing of baked, frozen sweet potato product as affected by baking x storage interaction

Baking (°C/min)	Storage (mo)	N	Acceptability ^a	Potential for purchasing ^b
			Color	
190/75-90	2	143	5.5 ^e	3.2 ^e
	6	139	5.9 ^{cd}	3.7 ^c
204/70-80	2	114	6.2 ^c	3.4 ^{de}
	6	111	5.9 ^d	3.5 ^{cd}

^a 1 = dislike extremely; 5 = like slightly; 6 = like moderately; 7 = like very much; 8 = like extremely.

^b 1 = I would never buy this; 2 = I would hardly ever buy this; 3 = I do not like this but would buy it occasionally; 4 = I like this and would buy it now and then; 5 = I would buy it frequently; 6 = I would buy this very often.

^{c-e} Means in a column within an interaction factor not sharing same superscript are different ($p < 0.05$).

Table 12 - Least-squares mean sensory scores of color, flavor, texture, and overall acceptability and potential for purchasing of baked, frozen sweet potato product as affected by interactions of experimental factors x replication with exception that texture means for storage x replication interaction were analyzed with a one-way Analysis of Variance and Tukey's Test

Factor	Replication	N	Acceptability ^a				Potential for purchasing ^b
			Color	Flavor	Texture	Overall	
Cultivar x Replication							
Cultivar							
Southern Delight	1	114			5.4 ^d		
	2	0			Non-estimable		
	3	113			4.8 ^e		
W-241	1	86			6.2 ^c		
	2	108			6.2 ^c		
	3	85			6.2 ^c		
Baking x Replication							
Baking (°C/min)							
190/75-90	1	114	5.9 ^{cd}				
	2	54	5.5 ^e				
	3	114	5.8 ^{de}				
204/70-80	1	86	6.2 ^c				
	2	54	6.1 ^{cd}				
	3	85	5.8 ^{de}				
Storage x Replication							
Storage (mo)							
2	1	116	6.0 ^c		5.6 ^e	5.4 ^{de}	3.3 ^d
	2	54	5.5 ^d		6.1 ^{cd}	5.3 ^{de}	3.2 ^d
	3	87	6.0 ^c		5.4 ^e	5.5 ^d	3.4 ^d
6	1	84	6.1 ^c		5.9 ^d	5.9 ^c	3.7 ^c
	2	54	6.0 ^c		6.4 ^c	5.7 ^{cd}	3.8 ^c
	3	*	5.5 ^d		5.4 ^e	5.2 ^e	3.3 ^d

* N = 112 for color acceptability and potential for purchasing; 111 for flavor, texture and overall acceptability.

^a 1 = dislike extremely; 5 = like slightly; 6 = like moderately; 7 = like very much; 8 = like extremely.

^b 1 = I would never buy this; 2 = I would hardly ever buy this; 3 = I do not like this but would buy it occasionally; 4 = I like this and would buy it now and then; 5 = I would buy it frequently; 6 = I would buy this very often.

^{c-e} Means in a column within an interaction factor not sharing same superscript are different (p<0.05).

replications was large. Some data points were missed by panelists so they were dropped in order to reduce bias. All discussion was concentrated on differences between 2 cultivars, 2 baking conditions, and 2 storage periods without regard to differences among replications.

Certain means (Table 12) were found to differ significantly ($p < 0.05$) among replications within several factors. A valuable lesson learned, herein, is that the greatest care must be given in preparation samples for sensory evaluation to prevent microbiological contamination.

Table 11 shows the differences among means of the baking x storage interaction for color acceptability and potential for purchasing the product. SP product baked at 190°C/75-90 min and storage for 6 mo and product baked at 204°C/70-80 min and storage for 2 mo had more acceptable color. Product baked at 190°C/75-90 min and stored 6 mo would more likely to be purchased than product baked at 190°C/75-90 min and stored 2 mo. The appendix F (Figure F.7-8) presents a graphic representation of the actual mean scores of color acceptability and potential for purchasing, respectively. Due to the spoilage problem, it is apparent that the missing data diminished value of the research.

CHAPTER V

SUMMARY AND CONCLUSIONS

The objectives of this experiment were to prepare a convenience-type product by stuffing pieces of baked sweet potato (SP) into cellulose casing followed by freezing and to determine some of the physical, chemical, and sensory attributes of the product.

Cured, stored SP roots were baked at 190°C for 75-90 min or 204°C for 70-80 min. After baking, they were peeled by hand and the flesh was sliced into pieces. Pieces were extruded into a cellulose casing. The casing, when filled, was tied-off in 20-cm sections. The "log" was wrapped with plastic film, frozen in an air-blast freezer at -34°C, and held at -17°C for 2 and 6 mo. Proximate analysis, Hunter color values, and retinol equivalents were measured to determine the effects of cultivar, baking condition, and storage time.

Baked SP products were removed from the freezer and heated in a microwave oven for 4 min before serving. Samples were evaluated by an untrained sensory panel of 30 members.

'Southern Delight' contained greater amounts of moisture and nitrogen-free extract, but lower amounts of crude fat, crude protein, and ash than 'W-241.' Baking and storage had no significant effect on all nutrients.

Hunter color values (L, 'a,' and 'b') were significantly different ($p < 0.01$) between cultivars. 'W-241' exhibited a more intense color than 'Southern Delight.' Baking temperature/time had no effect on L, 'a,' and 'b' values. Storage had little or no

effects on L, 'a,' and 'b' values. Storage up to 2 mo resulted in a more intense red product. The decrease in Hunter 'b' values with respect to frozen storage indicated a reduction of yellow color. 'W-241' contained 2.2% more retinol equivalents (RE) than 'Southern Delight.' Product baked at 190°C had 2.4% less RE as compared to product baked at 204°C. Storage had no effect on β -carotene content and RE. SP product stored 1 da after being baked at 204°C had 5.1% more β -carotene and RE than product baked at 190°C.

The sensory panel evaluated baked SP product for color, flavor, texture and overall acceptabilities and potential for purchasing. Acceptability of all attributes and potential for purchasing were affected by cultivar. 'W-241' was more acceptable than 'Southern Delight' and more likely to be purchased. SP product baked at 190°C/75-90 min after stored 6 mo had more acceptable color and would more likely to be purchased than product baked at 204°C/70-80 min. Product stored 6 mo had more acceptable flavor, and would more likely to be purchased than product stored 2 mo except the third replication.

This experiment has provided some valuable conclusions which include the following. The orange-fleshed SP can be prepared into an acceptable formed and frozen baked product to possess many of the desirable characteristics of a traditional baked SP product. Such a product has definite advantages over the baked root. It can be prepared in a variety of shapes and sizes, and it can be heated by microwave heating before serving. Cultivar was an important concern; some cultivars could be expected to yield a more satisfactory product. Temperature and time of baking should be established by the

processor to bake the roots most economically. Frozen storage of the product allowed certain product changes such that the panel gave higher scores for acceptability to samples stored 6 mo under 190°C/75-90 min baking condition. Because of the reported nutrient content and desirable color and flavor, the sweet potato has merit for processing as a prepared, frozen product.

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APPENDICES

Appendix A - Original sensory score sheet.

Panelist number _____
 Sample number _____

You will receive four samples of baked sweet potato on at a time. Please indicate how well you like or dislike the characteristics of the sample by checking the term that best describes your feeling toward that sample. Also indicate whether you would or would not buy the product if available. Use a clean spoon for each sample. Rinse your mouth with water before tasting the next sample.

Color	like extremely	_____
	like very much	_____
	like moderately	_____
	like slightly	_____
	dislike slightly	_____
	dislike moderately	_____
	dislike very much	_____
	dislike extremely	_____
Texture	like extremely	_____
	like very much	_____
	like moderately	_____
	like slightly	_____
	dislike slightly	_____
	dislike moderately	_____
	dislike very much	_____
	dislike extremely	_____
Flavor	like extremely	_____
	like very much	_____
	like moderately	_____
	like slightly	_____
	dislike slightly	_____
	dislike moderately	_____
	dislike very much	_____
	dislike extremely	_____
Overall acceptability	like extremely	_____
	like very much	_____
	like moderately	_____
	like slightly	_____
	dislike slightly	_____
	dislike moderately	_____
	dislike very much	_____
	dislike extremely	_____

Please check the appropriate comment.

I would buy this very often	_____
I would frequently buy	_____
I like this and would buy it now and then	_____
I do not like this but would buy it occasionally	_____
I would hardly ever buy this	_____
I would never buy this	_____

COMMENTS:

Appendix B - F-values from Analysis of Variance of proximate analysis of baked,
frozen sweet potato product

	df	Moisture	Attributes of solids				
			Crude fat	Crude protein	TDF ^a	Ash	NFE ^a
Replication (R)	2	0.59	6.41*	0.11	1.61	1.05	1.83
Cultivar (C) ^b	1	5,813.48**	5,119.12**	1,236.64**	0.21	131.92**	78.78**
Baking (B) ^c	1	4.57	2.88	0.85	3.14	2.04	3.93
Storage (S) ^d	2	2.12	1.65	0.42	1.00	0.60	1.49
R x C	2	0.54	2.18	0.57	0.71	0.24	1.18
R x B	2	0.22	1.82	2.19	0.89	0.22	1.18
R x S	4	0.79	3.76	0.85	1.01	0.40	1.12
C x B	1	0.26	0.53	0.14	0.85	0.12	1.11
C x S	2	7.08**	0.24	3.21	1.05	1.86	0.88
B x S	2	2.54	0.24	0.26	1.27	3.09	2.17
R x C x B	4	0.38	1.59	1.84	0.88	0.30	0.79
R x C x S	2	2.03	2.71	2.27	0.90	0.71	1.02
C x B x S	4	1.22	0.71	1.13	1.51	0.42	2.14
Error	8	-	-	-	-	-	-

* $p < 0.05$.

** $p < 0.01$.

^a TDF = total dietary fiber; NFE = nitrogen-free extract.

^b Cultivars were Southern Delight and W-241.

^c Conditions for baking were 190°C for 75-90 min and 204°C for 70-80 min.

^d Storage periods were 0, 2, and 6 mo.

Appendix C - F-values from Analysis of Variance of Hunter color measurements and retinol equivalents (RE) of baked, frozen sweet potato product

Factor	df	Color			RE
		L	'a'	'b'	
Replication (R)	2	3.00	0.31	0.50	1.03
Cultivar (C) ^a	1	1,824.14**	135.09**	120.07**	45.28**
Baking (B) ^b	1	3.57	1.23	1.79	52.70**
Storage (S) ^c	2	0.43	29.85**	28.36**	0.93
R x C	2	0.14	0.92	3.07	0.14
R x B	2	0.14	0.31	4.36	1.99
R x S	4	0.86	0.77	0.71	0.90
C x B	2	3.57	0.31	0.64	0.10
C x S	2	1.00	3.69	0.93	1.08
B x S	2	1.00	1.23	0.50	17.15**
R x C x B	2	1.86	0.31	1.50	2.03
R x C x S	4	1.43	3.23	1.57	0.95
C x B X S	2	1.00	0.31	1.93	0.71
Error	8	-	-	-	-

** p<0.01.

^a Cultivars were Southern Delight and W-241.

^b Conditions for baking were 190°C for 75-90 min and 204°C for 70-80 min.

^c Storage periods were 0, 2, and 6 mo.

Appendix D - Microbial counts (10^{-1}) of baked sweet potato stored at -17°C for 2 and 6 mo^a

Cultivar	Baking (°C/min)	Replication	Storage (mo)	
			2	6
----Log ₁₀ CFU ^b ----				
Southern Delight	190/75-90	1	<10est	<10est
	204/70-80	1	<10est	<10est
W-241	190/75-90	1	<10est	<10est
	204/70-80	1	<10est	60
Southern Delight	190/75-90	2	90	250
	204/70-80	2	163	40
W-241	190/75-90	2	<10est	<10est
	204/70-80	2	<10est	<10est
Southern Delight	190/75-90	3	<10est	<10est
	204/70-80	3	<10est	<10est
W-241	190/75-90	3	<10est	<10est
	204/70-80	3	70	<10est

^a Medium was violet red bile agar.

^b CFU = Colony forming units.

Appendix E - F-values from the General Linear Model of acceptability and potential for purchasing of baked, frozen sweet potato product

Factor	df	Acceptability				Potential for purchasing
		Color	Flavor	Texture	Overall	
Cultivar (C) ^a	1	144.35*	11.93*	78.93*	77.87*	47.86*
Baking (B) ^b	1	9.41*	0.12	0.08	0.69	0.00
Storage (S) ^c	1	0.05	3.26	0.84	1.09	8.64*
Panelist (S)	57	5.94*	5.43*	5.48*	4.99*	7.55*
Replication (R)	2	3.30*	0.02	1.52	1.42	1.82
C x B	1	0.68	2.40	0.00	1.62	1.14
C x S	1	0.09	2.42	0.01	0.01	0.75
C x R	2	0.65	2.89	9.75*	2.71	1.56
B x S	1	11.17*	1.84	2.30	2.32	5.13*
B x R	2	3.05*	4.44*	1.29	1.87	0.79
S x R	2	5.35*	1.88	4.47*	4.74*	3.65*
C x B x S	1	0.13	0.40	0.20	0.18	0.05

* $p < 0.05$.

Error = 507 for color acceptability and potential for purchasing; 506 for flavor, texture, and overall acceptability.

^a Cultivars were Southern Delight and W-241.

^b Conditions for baking were 190°C for 75-90 min and 204°C for 70-80 min.

^c Storage periods were 0, 2, and 6 mo.

Appendix F - Interaction plots for sensory data

Figure F.1 - Effect of cultivar x replication interaction on texture acceptability of a frozen, reheated sweet potato product (sensory scores: 4 = dislike slightly; 5 = like slightly; 7 = like very much)

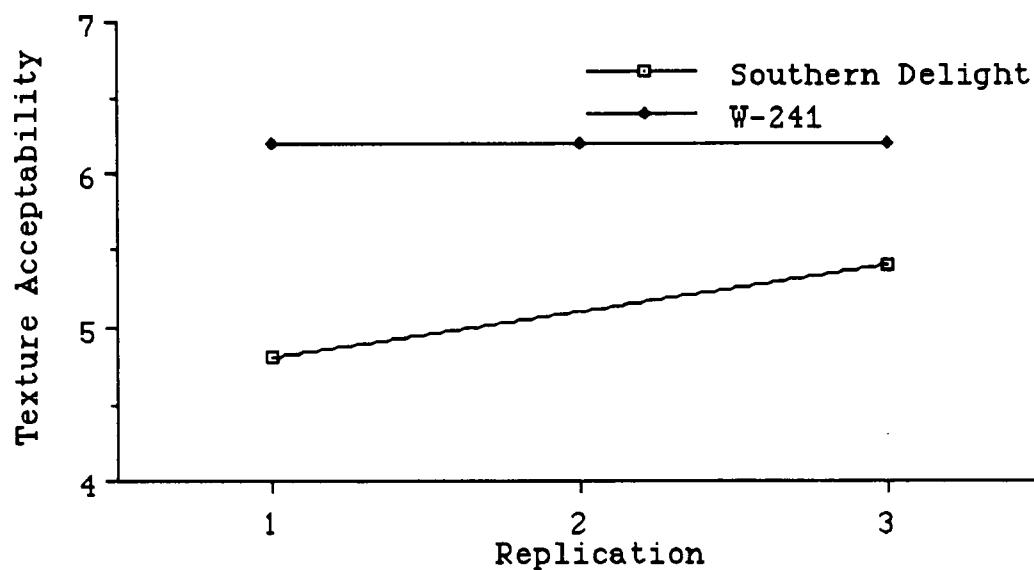


Figure F.2 - Effect of baking condition x replication interaction on color acceptability of a frozen, reheated sweet potato product
(sensory scores: 5 = like slightly and 7 = like very much)

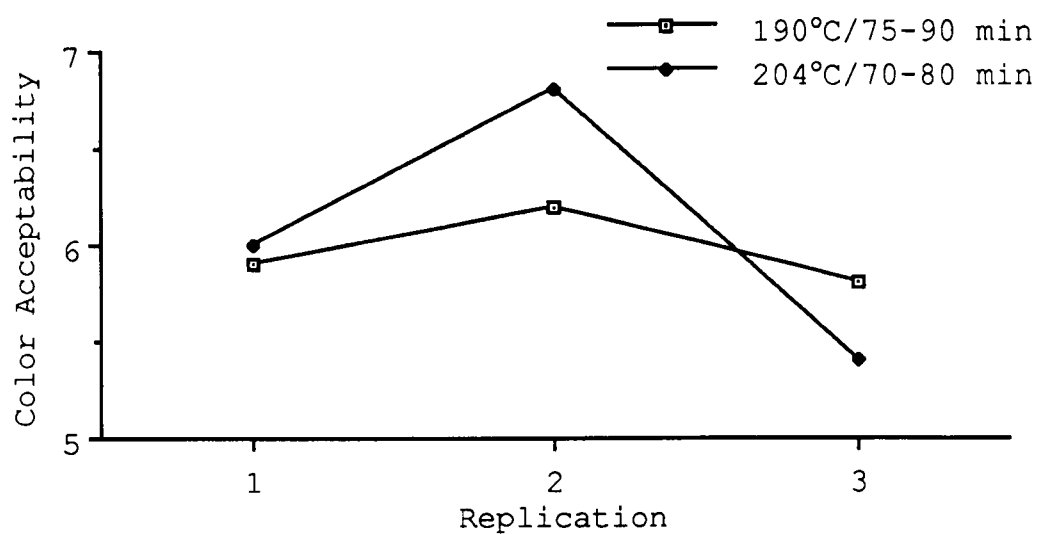


Figure F.3 - Effect of storage x replication interaction on color acceptability of a frozen, reheated sweet potato product (sensory scores: 5 = like slightly and 7 = like very much)

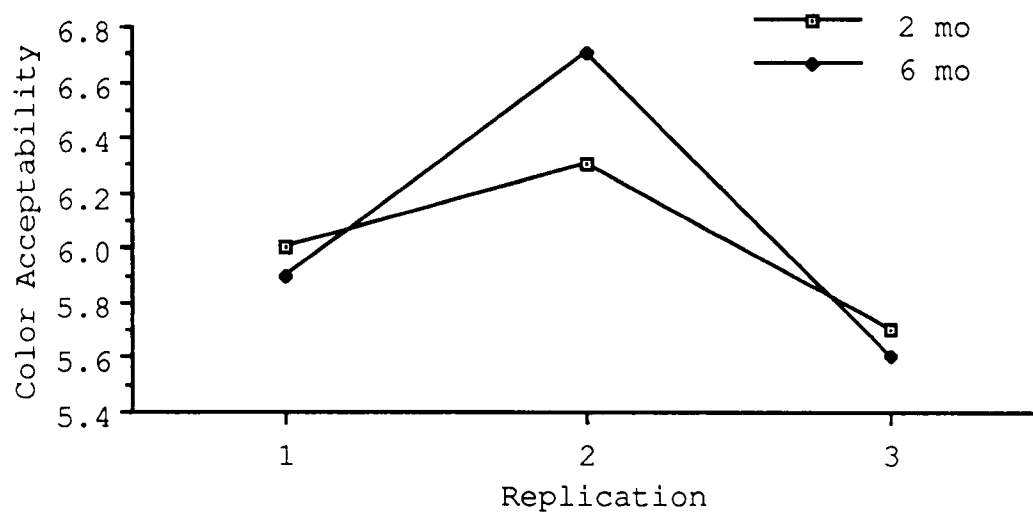


Figure F.4 - Effect of storage x replication interaction on texture acceptability of a frozen, reheated sweet potato product (sensory scores: 5 = like slightly and 7 = like very much)

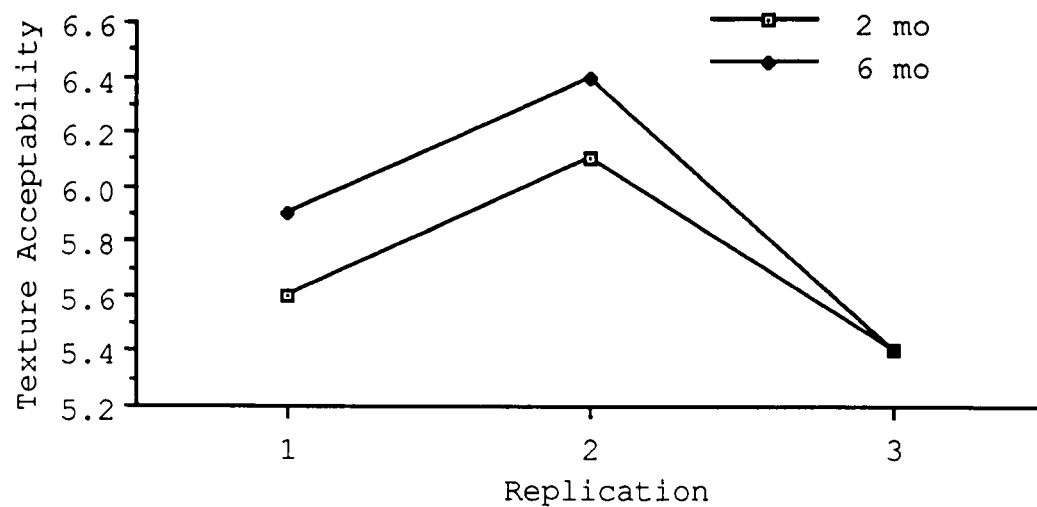


Figure F.5 - Effect of storage x replication interaction on overall acceptability of a frozen, reheated sweet potato product (sensory scores: 5 = like slightly and 7 = like very much)

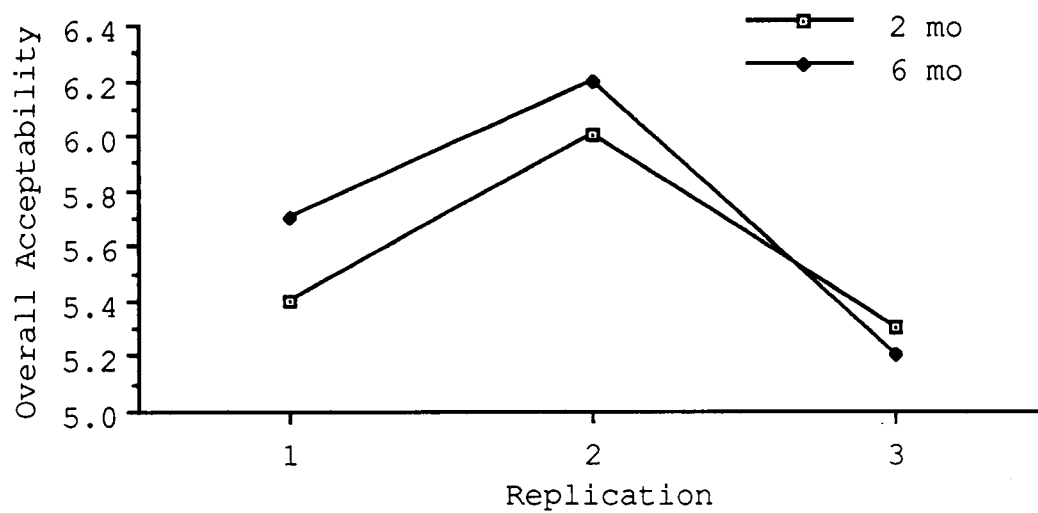


Figure F.6 - Effect of storage x replication interaction on potential for purchasing of a frozen, reheated sweet potato product (sensory scores: 3 = I do not like this but would buy it occasionally; 4 = I like this and would buy it now and then; 5 = I would buy it frequently)

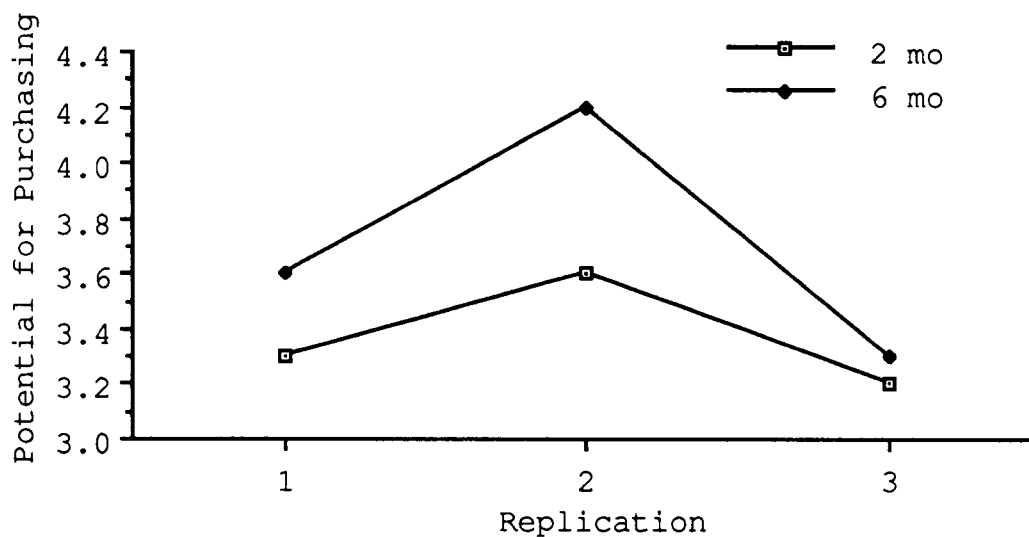


Figure F.7 - Effect of baking condition x storage interaction on color acceptability of a frozen, reheated sweet potato product (sensory scores: 5 = like slightly and 7 = like very much)

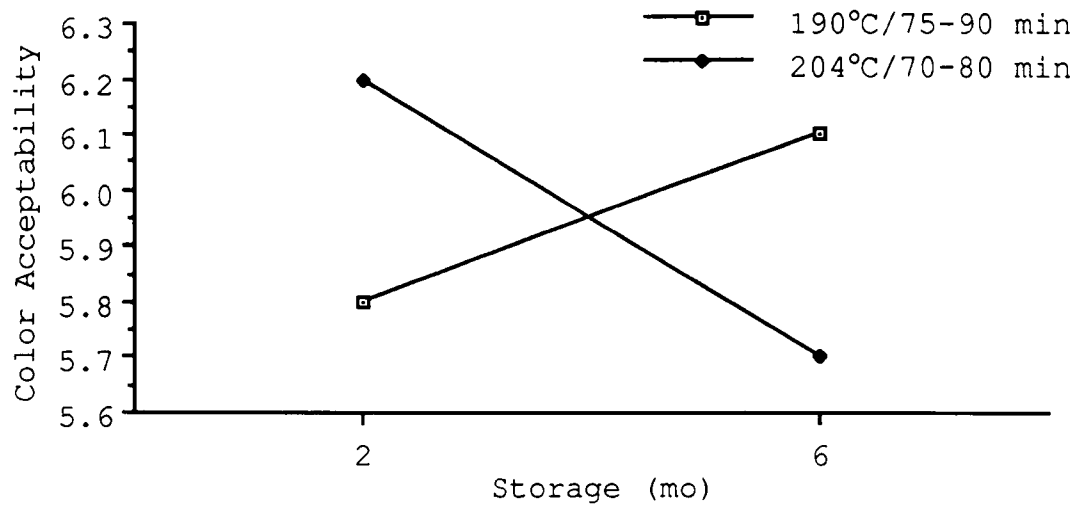
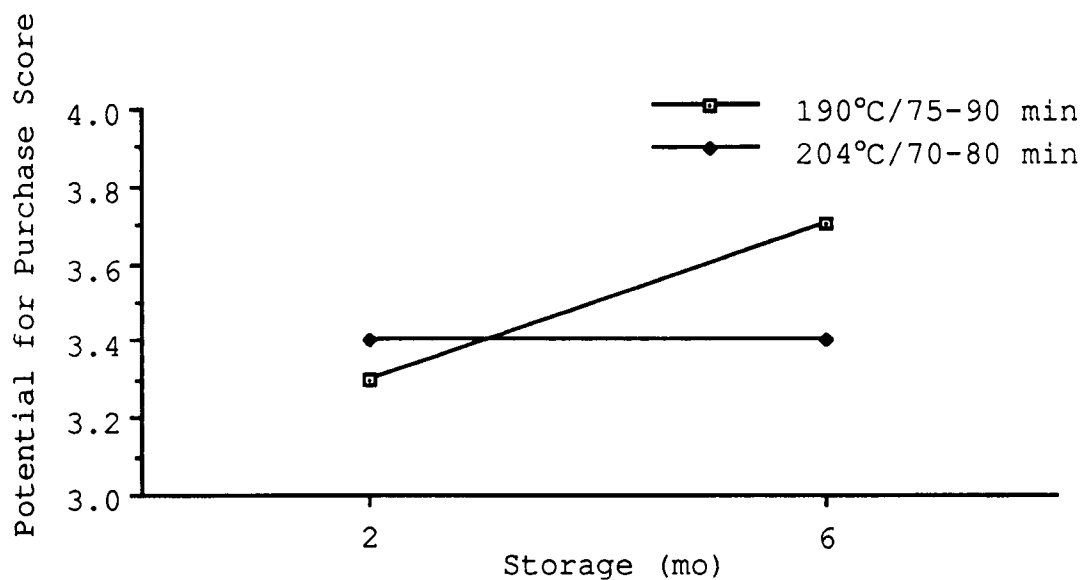


Figure F.8 - Effect of baking condition x storage interaction on potential for purchasing of a frozen, reheated sweet potato product (sensory scores: 3 = I do not like this but would buy it occasionally; 4 = I like this and would buy it now and then; 5 = I would buy it frequently)



VITA

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