MARKET OPPORTUNITIES FOR GRAIN AMARANTH AND BUCKWHEAT GROWERS IN MISSOURI

In cooperation with the Thomas Jefferson Agricultural Institute, the Missouri Department of Agriculture assessed potential market opportunities for grain amaranth and buckwheat in the following industries: baking, cereal, pasta, and flour milling. Results indicated the baking industry, particularly for production of specialty bread, as the most promising sector. The unique nutritional qualities associated with these grains (gluten free, high protein and high fiber content), combined with less chemical-intensive production techniques are cited as factors that may help these grains find a niche in the health and 'functional foods' market. The project also included an evaluation of the physical and nutritional properties of amaranth as an ingredient for use in baked goods conducted by the American Institute of Baking. The information was conveyed to bakeries, health food stores and celiac disease support groups in the region. The report outlines the next steps in identifying potential value-added opportunities for producers.

Final Report

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Report to the Federal-State Marketing Improvement Program
1400 Independence Avenue, SW
Washington, DC 20250

November 30, 2003

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Background

Opportunities exist to enrich many areas of our country, including Missouri, with a greater diversity of crops and agricultural-based enterprises. Grain amaranth and buckwheat represent two crops with potential in Missouri. Significant acreage increases for these two crops has been limited in Missouri due to a lack of current market opportunities. Market delivery points are located outside the state of Missouri and transportation costs erode profits. A number of businesses exist in Missouri that represent potential consumers of amaranth and buckwheat. These industries (cereal companies, bakeries, grain-based and pasta manufacturers) were not aware of the nutritional data for amaranth and buckwheat or that local supplies can be available.

Both amaranth and buckwheat can be produced with minor production adjustments in farming operations and are experiencing an increase in popularity. Detailed below is a brief overview of each crop.

Grain Amaranth

Grain amaranth's commercial production in the U.S. began in the late 1970s, grew through the 1980s, and has fluctuated since then. Total U.S. acreage for the last decade has been very small, typically in the 1,500 to 3,000 acre range. As with many small acreage crops, over-production has sometimes occurred when acreage went up too rapidly following a year with high prices and strong demand. The relatively high price of amaranth, usually 10-fold the price of corn on a per weight basis, has often spurred farmer interest.

The crop is widely adapted and can be grown with conventional grain crop equipment, though the small seed size makes mechanical handling somewhat difficult. The drought tolerant nature of amaranth has led to its current base of production being in the High Plains of western Nebraska. In the past ten years, amaranth has also been grown for grain use in Iowa, Minnesota, North Dakota, Montana, Kansas, Pennsylvania, and in other scattered locations.

The commercial marketplace for amaranth in the U.S. has been primarily based on the health food market. Consumers purchasing amaranth are usually doing so because they (a) want a wheat and gluten free product, (b) like the nutritional profile of amaranth, and/or (c) like more "exotic" foods in their diet. For amaranth to find broader acceptance in the food industry, it will have to overcome several hurdles. Price will have to come down, to make it more competitive with other grains, though it should still carry a price premium. More consumers will have to recognize the nutritional benefits of the grain,

which will be difficult unless a food manufacturer starts to invest in advertising. Larger supply of seed will have to be available to entice the larger food manufacturers to even consider trying it; some food processors have indicated they are unwilling to get involved in contracting for a crop and waiting several months for it to be grown.

Buckwheat

Buckwheat has long been cultivated in North America, being identified with buckwheat pancakes, and with its short season growth filling a niche as a cash crop for farmers. At its peak, more than a million acres of buckwheat were grown in the U.S. Current production centers in and around North Dakota, where approximately 40,000 acres are produced annually. Buckwheat can be grown as a double crop behind winter wheat in the Southern Midwest corn belt and in 1993 & 2000 about 1,800 acres were grown in Missouri. The price of buckwheat has been relatively stable at around $0.10 per pound, and the yield is around 1,000 pounds per acre.

Buckwheat is widely adapted and can be grown with conventional grain crop equipment. The short season nature of the crop has given rise to its cultivation in the North Dakota area and further north. However, it can fill a vital niche as a double crop behind winter wheat, canola, or flax, accepting a planting date up until very early August in the Southern Midwest corn belt. Due to its high seeding rate and tendency to 'smother weeds', no herbicides are typically used with buckwheat. Pests and diseases are rarely reported with its production. Buckwheat has a reputation for improving the soil, and farmers generally report a yield increase on the ensuing crop. Buckwheat is easily stored, handled and transported.

Buckwheat is primarily a human food crop, used in similar fashion to cereal grains such as wheat or oats. Even though buckwheat is not a true cereal, it is sometimes called a "pseudocereal." Buckwheat seeds are dehulled, and the remaining seed material, called a groat, is ground into flour. The flour has numerous uses, blended with wheat flour for pancakes, bread, pasta, noodles, and cereal, as well as the sole ingredient of some polenta. Buckwheat is extremely nutritious, being considered one of the best sources of high quality, easily digestible protein in the plant kingdom. It complements and improves cereal flour nutrition, being high in lysine, and essential amino acids which most grains are deficient in. Pasta produced from a mixture of wheat and buckwheat, including egg yolk, vital gluten, and skimmed powdered milk, has a shorter cooking time, offering the opportunity for packaged rapid preparation foods. Buckwheat can also be used to produce extruded cereal and snack products where its nutritional character can enhance the final product. In Japan, buckwheat and wheat flour are used to make the popular "soba" noodles. In Russia, where buckwheat is native, it is used in a variety of food products, including roasting the whole groats to make "kasha." Americans are most familiar with buckwheat from hearty-flavored buckwheat pancakes. Buckwheat is high in lysine relative to wheat and corn. The protein content of dehulled buckwheat is about 12%, with only 2% fat.

With the U.S. exporting 95% of the buckwheat it produces, an increase in U.S. food products that use buckwheat would help to broaden the market for U.S. farmers. Buckwheat is compatible for making a broad range of food products, and it's nutrition is highly complementary to cereals.

Project Overview and Objectives

In an effort to explore opportunities for new markets for amaranth and buckwheat, the Missouri Department of Agriculture and the Thomas Jefferson Agricultural Institute joined efforts to identify and quantify marketing opportunities. The project was funded through a grant received from the United States Department of Agriculture Federal State Marketing Improvement Program. The overall goal of this project was to create and expand market opportunities for Missouri amaranth and buckwheat producers through marketing and outreach efforts with perspective end-use consumers. Completion of this project was intended to accomplish the following specific objectives:

- Quantification of market opportunities for grain amaranth and buckwheat as it relates to cereal manufacturers, pasta manufacturers, manufacturers of grain-based food products, bread manufacturers, and buyers for the export market in Missouri
- Development and implementation of a targeted outreach effort with end use consumers in Missouri and surrounding states
- Identification of market development obstacles or additional research and testing needs
- Development of partnership opportunities with Missouri-based food manufacturers and farmers
- Identification of potential value-added opportunities for farmers

Quantification of Market Opportunities

Initial efforts centered on a targeted assessment of each of the following market segments:

- Baking
- Pasta Manufacturing
- Cereal Production
- Flour Milling
- Health Related Stores
- Grain-based Products

Each of these market segments were detailed and industry trends and structure, market trends & growth, market segmentation, and strategic opportunities were identified. In addition to the four industry segments originally identified in the proposal (cereal manufacturers, pasta manufacturers, manufacturers of grain-based food products, bread manufacturers), the milling industry and health food markets were also investigated.

Amaranth and/or buckwheat products are currently manufactured and marketed in each of the previous industry segments. The Missouri Department of Agriculture and Jefferson Institute personnel met on multiple occasions to discuss each of the industry segments and where to focus *initial* marketing efforts. Based on the information gained, the baking industry is viewed as the most likely industry to increase market penetration. Detailed below are highlights of the baking industry analysis. A copy of the more detailed baking industry analysis is attached to this report as Appendix A. In addition, industry overviews for the cereal industry, pasta manufacturing, and flour milling are also presented in Appendix B.

Baking Industry Market Analysis Summary

The composition and production practices utilized to grow buckwheat and grain amaranth lend themselves to the growth areas of the breads market. Specifically, both crops can be grown organically with relative ease. In addition, amaranth specifically has an excellent nutritional profile. Both crops do not contain gluten and are options for those suffering from celiac issues. Both products also offer a different taste and texture than wheat flour, although it is not determined if this a positive or negative marketing attribute. Although additional testing is needed, preliminary factors suggest that the baking industry, specifically the specialty breads market segment, may represent marketing opportunities.

Bakeries are a significant industry in the U.S.; producing a product utilized by almost every household. In fact, 98% of U.S. households purchased fresh bread in 2001 spending, on average, $2.09 for every loaf purchased. In addition, the industry is not concentrated with the top four firms commanding only 44% of the market. Thus, a large number of small and medium firms exist.

Trends in the wholesale commercial baking industry point toward the production of premium and super premium brands. In addition, organic and specialty (artisan) breads continue to grow in acceptance. The premium and super premium categories are increasing in popularity due to consumer's desire to have bread with specific traits. Consumer surveys conducted by Sara Lee point to variety, health, use of natural products, organic, and convenience as reasons they buy specific bread brands.

The properties of amaranth and buckwheat, from a nutritional perspective, show promise to be incorporated into the baking industry; however, nutrition profiles are only one perspective. Firms must also consider production economics and operational issues.

Limitations on the use of new grain components such as amaranth and buckwheat will center on costs, as well as supply limitations and data on baking characteristics. The following table highlights the approximate cost components of the wholesale commercial baking industry (the specialty bread market cost structure will differ). As the reader can see, ingredient costs represent up to one-fourth of the cost of a loaf of bread, and typically more for specialty breads. Flour is approximately one-half of the ingredient costs. Any increase in flour costs will create a cost disadvantage compared to competition, specifically in the popular and private label brands. There may be some flexibility in the premium and super premium brands where customers are looking for a specific ingredient, taste, or nutrition profile.

Components of Costs Associated with the Baking Industry	
	Approximate % of Total Cost
Labor and Fringe	>40
Ingredients	20-25%
Flour (10-12%)	
Packaging	6-7%
Marketing & Advertising	3-4%
Fuel	1-2%
Depreciation & Amortization	6%
Other	>16%

Increased consumer demand for specialty breads has opened the doors for new types of bakeries, notably retail bread stores. It has also created sales opportunities for supermarket bakeries, cafes, full-line retail bakeries, specialty wholesale bakeries, and foodservice operations with bakeries. Artisan breads typically cost $2 to $5 per loaf. These prices represent an acceptance issue for cost-conscious individuals, but may represent an opportunity for inclusion of higher priced grain or grain products that either produce a higher quality product or help fulfill a nutritional profile. Within the specialty breads category, interest is increasing for par-baked and frozen artisan dough. Some analysts believe that these two products could lead to a decrease in small, retail bakery and specialty retail or wholesale operations. Detailed below are the various market segments of the baking industry:

Commercial Wholesale Bakeries
The commercial wholesale bread market can be segmented into the following categories:

- Super premium
- Premium
- Popular
- Private label

Top wholesale baking companies in 2002 are detailed in Appendix A.

In addition, the specialty bread market has been a growing market segment. This segment can be broken into the following sub categories:

- Supermarket bakeries
- Full-line retail bakeries
- Specialty retail, wholesale bread bakeries
- Restaurants, bakery cafes, hotels, foodservice, etc.

Specialty breads are primarily purchased by couples with no children or whose children have left the home, young consumers with discretionary income, and consumers more than 45 years of age. This market segment is estimated to have had approximately $6 billion in sales in 1996.

In-Store Bakeries
Consolidation within supermarkets has led to increased dependence upon value-added operations such as in-store bakeries. Two major forces are credited by industry sources for increased consolidation and the trend toward supermarket in-store bakeries. Mass merchandisers and discounters are grabbing a larger market share of the retail food market. For example, Walmart Supercenters now number among the ten largest bakery operators. Many supermarkets feel they must have in-store bakeries to compete.

Second, supermarket companies are merging to survive. Consolidated supermarkets are relying upon perishable departments such as bakeries to maintain market share and establish a competitive position. The largest in-store bakeries are also detailed in Appendix A.

In-store bakeries depend upon quality and variety to secure and maintain their customer base for specialty breads. Price points remain an issue with many in-store baking operations. Although some in-store operations market their loaves at premium prices (similar to retail bread bakeries) many price their products similar to bread in the grocery aisle. In fact, industry sources documented in 1996 that the average price for a one pound crusty Italian bread was $1.46 as compared with $2.12, the average price for similar bread on the grocery isle.

Due to the need to cut expenses, some supermarkets also have come to regard bakery items as convenience purchases. Essentially this attitude leads in-store bakeries to price products as a commodity instead of a premium product. Some industry analysts sum it up by stating, some supermarkets treat in-store bakeries as a convenience rather than a destination.

These attitudes have led to an increase of popularity of other firms that offer specialty breads, deemed “category killers” by the supermarkets. It should be noted that “not all stores are alike” and some in-store bakeries approach baking as a “destination experience” and not a commodity product.

Bakery Cafes
European style bakery cafes entered the baking scene in the 1980s. By 1996, bakery café chains with ten or more stores operated 2,000 units across the United States.

Specialty Retail and Wholesale Bakeries
Consumer demand for greater varieties took hold in the last decade with the rise in popularity of artisan style breads. Specialty wholesale bakeries such as Acme Bread (Berkeley, CA), Bread Alone (Boiceville, NY), and La Brea Bakery (Los Angeles, CA) have established themselves in the marketplace.

Retail Bread Bakeries
Retail bred bakeries such as Great Harvest Bread Company (Dillon, MT) have also established themselves in the specialty bread market. These firms rely heavily upon quality to receive premium prices, $2.50 up to more than $5.00 per loaf, for their products. According to Modern Baking (September, 1998), the four largest retail bread bakery chains were Great Harvest Bread Co., Breadsmith, Big Sky Bread Co., and Baker Street Artisan Breads operating more than 230 stores in 1998.

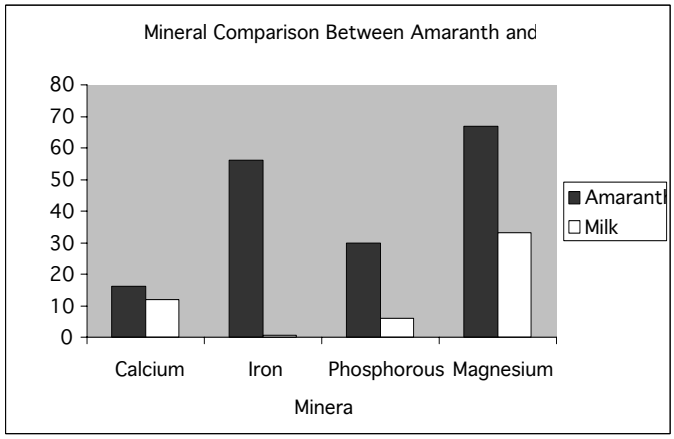
An interesting aspect of the specialty bread market is that greater bread sales do not appear to come at the expense of other in-store breads. Instead, customers appear to purchase both. Furthermore, most segments of the specialty bread market point to the need for consumer education as a major challenge for their industry.

Based on the attributes of buckwheat and grain amaranth derivatives (i.e. flour), the specialty bread segment appears to offer the largest market opportunity. Specifically within the specialty bread segment, full-line retail bakeries, and specialty retail/wholesale bakeries appear to be market segments to target, with in-store bakeries being a third focus area.

Organic Opportunities
Within all of these segments and subcategories, consumers have made room for organic products as well as partial baked breads.

Bread Mix Manufacturers
From the perspective of sales of new ingredients such as buckwheat and amaranth the "baking mixes" industry cannot be overlooked as many bakeries purchase ingredients (such as additive packs containing whole grains) from these firms.

Strategic Opportunities
Amaranth specifically has a number of properties that lend itself toward filling the niche of "functional foods" and the trend toward healthy products. Amaranth contains 14-16% protein. This is greater than the protein found in wheat (12-14%), rice (7-10%) and corn (7-10%). Amaranth contains all eight essential amino acids, (which must be obtained through consumption rather than synthesis) and is high in both lysine and methionine. Lysine is a limiting amino acid in wheat, corn and rice, but when amaranth is combined with these grains, a protein as complete as that found in fish, red meat or poultry is formed.



Amaranth has twice as much fiber as corn and oats and three times as much as wheat. Amaranth provides a source of cholesterol-lowering agents such as fiber, linoleic acid and tocotrienols. Tocotrienols found in amaranth help the body fight aging, protect fatty areas of the body from damage by free radicals and may also help maintain heart health. Lysine contained in amaranth helps maintain and repair our body tissues.

Gluten-free: For those who cannot tolerate gluten in the diet (e.g. those with Celiac disease, etc.), amaranth provides a way to incorporate wheat-free products in the diet. High digestibility: (86 to 90%) of amaranth's protein is digestible. Amaranth is also an excellent source of calcium, iron, magnesium and folate.

Buckwheat flour offers a similar healthy profile, although not to the same degree as amaranth flour.

The composition and production practices utilized to grow buckwheat and amaranth lend themselves to the growth areas of the breads market. Specifically, both crops can be grown organically with relative ease. In addition, amaranth specifically has an excellent nutritional profile. Both crops do not contain gluten and are options for those suffering from celiac disease. Both products also offer a different taste and texture than wheat flour, although it is not determined if this a positive or negative marketing attribute.

As documented in the previous information, specialty bread bakeries depend upon quality, nutrition, and variety more than price points to attract and maintain customers. These market elements represent opportunities.

Identification of Obstacles or Additional Research and Testing Needs

Initial discussions with retail bakeries and companies that market amaranth products highlighted the fact that limited awareness exists about buckwheat and amaranth products. Specifically, much of the market is not aware of the nutritional profile of amaranth and amaranth flour. In addition, these initial discussions identified the lack of testing that has been performed on amaranth. Therefore activity was concentrated on amaranth and amaranth products.

In an effort to provide the most relevant and credible information to bakeries and other companies that might utilize amaranth, The Missouri Department of Agriculture provided grant funds and the Jefferson Institute facilitated testing at the American Institute of Baking (AIB). AIB is recognized as one of the major centers for grain product research and development in the entire world. AIB performed tests to evaluate the inclusion of toasted amaranth flour in baking formulations. A whole grain bread was formulated with the use of amaranth flour in addition to the flour and grains typically used. Amaranth was added at levels of up to 20%. AIB determined it was necessary to increase the added wheat gluten and total water. Results were comparable to 100% wheat until the 20% addition level of amaranth flour. This research showed that amaranth could be blended with wheat flour to improve product nutrition, without affecting baking performance.

In addition to the whole grain formulation, a gluten-free baked product was also formulated. Amaranth flour was added at a minimum level of 10% on a total percent basis to a gluten-free banana bread formulation. AIB judged that the use of a combination of rice flour, corn and potato starch in conjunction with the amaranth flour produced a finished product of good quality. A summary of the test is contained in Appendix C. In addition to the formulation, AIB tested for gluten content. The test documented that gluten was ***not detected*** at the 20 parts per million (ppm) level in amaranth flour. Test results are in Appendix D.

Continued discussions with potential consumers yielded the following additional issues that will need to be addressed to increase the demand for specialty crops such as amaranth or buckwheat:

- Price remains an issue. Breeding, specifically for amaranth, must be encouraged to increase yields thus allowing for more competitively priced amaranth seed.
- Additional testing and development is needed to address flavor issues.

- Sufficient supply remains an issue for large firms thus presenting a “chicken and egg” scenario.
- Additional testing and formulation is needed with amaranth flours.
- The celiac market presents a market opportunity, however celiac groups have requested additional testing to confirm amino acids and sequencing of those amino acids.

Development and Implementation of a Targeted Outreach Effort

The information gained from the testing at AIB was utilized to develop an outreach mailer for the baking industry. A similar mailer was also sent to health stores in Missouri and surrounding states.

Bakery Outreach Mailer

This mailer consisted of a cover letter introducing specialty flours and its attributes. A one page front and back piece was also included that highlighted functional and nutritional properties of amaranth flour. Approximately 2,300 wholesale and retail bakeries were identified in the Missouri region (Missouri, Illinois, Iowa, Nebraska, Kansas, and Oklahoma). Information was sent to all of these firms. In addition, a mailer was sent to businesses that handle breads, rolls, and buns. Although these firms do not manufacture bread, they may serve as “consumer pull” for the specialty crop fours (maps of locations for these firms can be reviewed in Appendix E).

Outreach materials were also targeted to specific elements of the specialty bread market. As outlined in the market summary (attached in Appendix A), the specialty bread market segment may offer some of the best opportunities for the introduction of specialty flours. Retail bread bakeries, bread cafes, specialty wholesale & retail bakers, and in-store bakeries are elements of this market segment that have incentive to consider amaranth or buckwheat flour. These elements depend upon quality, nutrition, and variety (not necessarily price point) to attract and maintain consumers. Beginning with retail bread bakers, the headquarters and franchise operations of the top four US companies were identified and outreach information mailed to them. In-store bakeries that bake from scratch were also identified and received information. In all, more than 400 packets were mailed to retail and in-store bakers.

Health Food Store Mailer

Based on work from the first quarter of the project, health food stores were also identified as an industry that presented an opportunity to expand the consumption of amaranth and buckwheat. More than 1,400 health stores in the six state region were identified as a potential market for buckwheat grouts, amaranth seed, and their derivatives (i.e. flour). Information was mailed to these firms as well (identified on the maps in Appendix E).

Development of Partnership Opportunities

Project team members worked to identify companies that may be interested in purchasing amaranth or buckwheat from Missouri farmers or incorporating amaranth or buckwheat flour into their products. In addition, efforts were extended to form linkages with consumer groups that might be able to assist with creating demand.

Linkage with Celiac Organizations

People with celiac disease cannot tolerate ingestion of gluten-containing products like wheat, rye and barley. Sensitivity and reactions vary from person to person. According to the Celiac Sprue Association, “the condition of celiac disease results in a malabsorption syndrome.” To deal with their gluten intolerance, celiacs consume grains that are gluten-free. Amaranth and buckwheat represent two grains that may be incorporated into celiac diets. Celiac patients provide a great market opportunity for the sale of gluten-free products in both grocery and special food stores.

A growing communications network exists among groups that represent celiac patients. These support groups aid sufferers by providing current information on the disease and methods to cope; including diets that are suitable. Project team members identified more than 300 groups. Some celiac support groups were already aware of amaranth and buckwheat, however many did not have a position. In some cases, the support groups actually did not recommend the use of grain amaranth.

The Jefferson Institute evaluated the source of confusion over whether amaranth is actually gluten-free. We believe this confusion came about because there are retail products, such as "amaranth cookies" or "amaranth cereal" that are not 100% amaranth, but instead have a significant amount of wheat mixed with amaranth flour. Letters were mailed to these groups, with test results from the American Institute of Baking attached, urging them to consider a statement such as, "Amaranth flour has been confirmed by testing as gluten-free. However, some processed food products, such as cereals or snacks, which are labeled as amaranth products do contain wheat, so be sure to read the ingredient label. If you buy 100% amaranth flour for your own baking, it will be free of gluten."

In addition, test results were also mailed to support groups that did not have any information about amaranth. These letters urged the groups to disseminate the new information and adopt a positive position statement about grain amaranth. Finally, the test results were also sent to support groups that currently support the use of amaranth products for celiac patients. An example of one of the letters sent can be viewed in appendix F. Response to this mailing has been good and future interaction with celiac groups will be continued.

Interaction with Individual Companies

An extensive effort was also undertaken to work with individual companies, both those that responded to previous mailings and other groups that were identified. The interaction was primarily in the form of responding to requests for additional information.

Identification of Potential Value-Added Opportunities for Producers

Even with the project efforts, markets in Missouri for amaranth and buckwheat remain limited. Therefore less effort was expended on developing value-added opportunities for producers at this time. However, at least two value-added opportunities were identified as demand for amaranth and buckwheat increases. Specifically, producers may benefit from:

- Cooperative effort to clean and ship amaranth or buckwheat to millers
- New generation cooperatives to mill and package amaranth and buckwheat products

Purchasers of whole grain amaranth require the seed to be cleaned to specification and packaged to their needs. Private discussion with purchasers and jobbers indicates that sufficient margins exist to provide an opportunity for producers to operate cooperatively and clean/package amaranth in the current marketplace. The limiting factor is the current size of market and length of time that processed amaranth may have to stay in inventory, thus creating cash flow issues. This value-added opportunity represents a relatively low-risk opportunity and would be a first step in value-added processing.

In the future, producers may also wish to examine the economic viability of processing amaranth and buckwheat into flour and byproducts. Prior to this step, additional formulation testing will be required for amaranth and additional work on by-product markets (such as buckwheat hulls) is needed.

Project Summary and Conclusions

The completed project was successful on multiple levels. The overall goal of the project was to increase awareness and demand for buckwheat and amaranth and to create the opportunity for Missouri producers to raise either crop under contract. Due to the funding of this project, literally thousands of bakeries and health food stores are now aware of amaranth and buckwheat and it's beneficial nutrition qualities. Although some of these firms were previously aware of the two crops (and it's products), most were not.

In addition, the effort was successful in leveraging resources and conducting formulation testing with the American Institute of Baking. Tests were also conducted to confirm that amaranth is gluten-free. This information was conveyed to bakeries, health food stores, and celiac support groups. Although some testing was completed, an enormous amount of effort remains. Additional effort is needed to secure resources for product development research.

Although value-added companies owned by producers may be premature, production contract opportunities exist for Missouri producers in 2004 and the Jefferson Institute will begin work in the Spring of 2004 to facilitate those opportunities.

Appendix A

Baking Industry Overview

The composition and production practices utilized to grow buckwheat and grain amaranth lend themselves to the growth areas of the breads market. Specifically, both crops can be grown organically with relative ease. In addition, amaranth specifically has an excellent nutritional profile. Both crops do not contain gluten and are options for those suffering from celiac issues. Both products also offer a different taste and texture than wheat flour, although it is not determined if this a positive or negative marketing attribute. Although additional testing is needed, preliminary factors suggest that the baking industry, specifically the specialty breads market segment, may represent marketing opportunities. The following analysis has been prepared to detail aspects of the baking industry and address potential strategic opportunities for the sales of grain amaranth and buckwheat and its derivatives.

Industry Analysis

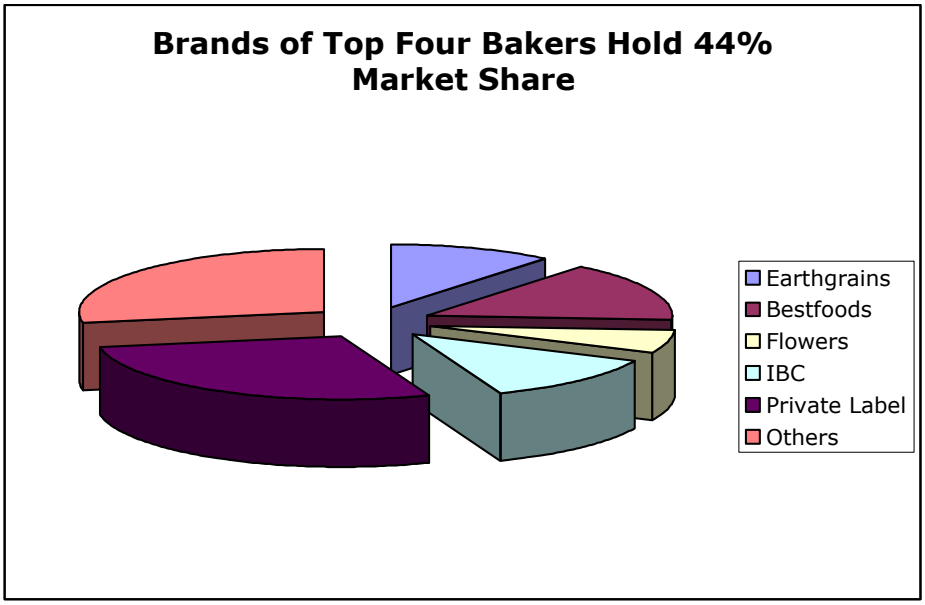
General Description

The 1997 Economic Census reports more than 2700 commercial bakeries operate in the United States. A majority of these commercial bakers are manufacturers of breads (including wheat, white, rye, and frozen). New York and California have the largest number of commercial bakeries operating within their state boundaries, followed by states such as Illinois, Florida, Massachusetts, New Jersey, Pennsylvania, and Texas.

Structure

Concentration

The CR_4 ratio for the commercial wholesale baking industry is approximately 44% according to industry sources. The figure below indicates the top firms in the industry.



Participants

The top US bread vendors include:

Top Bread Vendors	Dollar Sales
Interstate Bakeries Corporation	$742,673,664
Earth Grains (now Sara Lee)	$593,996,288
Arnold/Oroweat/Brownberry	$538,483,136
Flowers Bakeries	$407,211,200
Pepperidge Farm	$260,972,928
Merita	$126,282,224
United State Bakery	$118,305,504
Bimbo USA	$117,432,128
Stoehmann	$104,519,296
Best Foods	$100,592,126

Source:Information Resources, Inc.

A listing of the top 88 wholesale baking companies (including other products besides breads) is attached as an appendix. Within the retail bread industry, the following firms are the leading brands:

Leading Bread Brands

Brand
Wonder
Oroweat
Pepperidge Farm
Nature's Own
Sunbeam
Home Pride
Arnold
Merita
Stroehmann

source: IRI, for year ending April 28, 2002

Specialty bread operations (detailed in the market analysis section) do offer opportunities for amaranth and buckwheat products, however these operations are small relative to the wholesale baking companies and therefore do not appear on the previous lists for leading baking operations.

Market Analysis Summary

Bakeries are a significant industry in the US; producing a product utilized by almost every household. In fact, 98% of US households purchased fresh bread in 2001 spending, on average, $2.09 for every loaf purchased. In addition, the industry is not concentrated with the top four firms commanding only 44% of the market. Thus, a large number of small and medium firms exist.

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Fuel	1-2%
Depreciation & Amortization	6%
Other	>16%

Market Trends

According to the February, 2002 issue of Milling & Baking News, the emerging trend in bread is the enhancement of its healthful properties, to the extent that some formulations address specific illnesses. The concept of diet as the cornerstone for maintaining wellness and nutrition is taking hold among U.S. consumers, and it appears to have positive implications for bread.

Baking companies are creating formulations to address nutritional concerns of different demographic groups. Recent product introductions emphasize ingredients and health-promoting benefits never before utilized in wholesale baking; this movement may signal a change taking place in consumers' perception of bread and its role in the diet.

Responding to consumers' quests for achieving optimum health or for finding the "fountain of youth," scientists and food manufacturers are pursuing numerous opportunities in a developing segment of the food industry called "functional foods." (Milling & Baking News, January 23, 2001)

According to Earthgrains, new product development is focused on consumer trends. Consumers, through surveys, have indicated they purchase breads based on **variety, health, use of natural products, organic, and convenience**.

Increased consumer demand for specialty breads has opened the doors for new types of bakeries, notably retail bread stores. It has also created sales opportunities for supermarket bakeries, cafes, full-line retail bakeries, specialty wholesale bakeries, and foodservice operations with bakeries.

Artisan breads are emerging as a major growth vehicle for leading U.S. supermarket chains (Milling & Baking News, May 7, 2002). Artisan bread began to enter the mainstream at U.S. supermarkets in the mid-1990s. Today, roughly 40% of U.S. supermarkets have the "right" customer base to sell artisan bread, compared with 10% several years ago. These statements were made by Bob Kulpinski, president of McGlynn Bakeries L.L.C. and Concept 2 Bakers and reported in Milling & Baking News.

Artisan breads typically cost $2 to $5 per loaf. These prices represent an acceptance issue for cost-conscious individuals, but may represent an opportunity for inclusion of higher priced grain or grain products that either produce a higher quality product or help fulfill a nutritional profile.

Within the specialty breads category, interest is increasing for par-baked and frozen artisan dough. Some analysts believe that these two products could lead to a decrease in small, retail bakery and specialty retail or wholesale operations.

Increasing interest in artisan bread also means greater demand for special flours. Companies such as General Mills, Inc. produce winter wheat flour that is specially milled for artisan baking. One supplier said artisan bakers generally prefer untreated, low-protein flours made from winter wheat. ADM Milling Co. is working to develop special flours for artisan bread such as Golden Loaf Artisan Bread Flour. Milder flours with medium-range protein content (11.8%) will be beneficial because artisan bread is not developed in large-scale mechanical mixing.

Organic flour, which can be twice as expensive, is reported to be in high demand. Some believe that organic sales will get a lift this year when national organic standards take effect. Beginning on Oct. 21, producers and handlers must be certified by a USDA accredited certifying agent to sell, label or represent their products as "100% organic," "organic" or "made with organic (specified ingredients or food group[s])," according to the U.S. Department of Agriculture.

Market Segmentation

In conjunction with the growth of super premium brands, the bread category has seen a surge in nutrition-based products, according to Carla Schaeffer, popular brands, Sara Lee Bakery. With new products coming out targeting kids, women and seniors, the result is "customized bread based on nutritional needs and demographics," she said.

Chris Ruzicka, director, super premium brands, Sara Lee Bakery, also noted the differentiation going on in the super premium category and the connection with nutritional claims. "The super premium consumers we talk to say that texture is important to them more and more," he said. "They want crunch and they equate that with a more healthy product. I have heard that a lot more recently than in the past."

Surprisingly, some firms are reporting that the targeting of females and kids as created a backlash among males in some geographic regions. Firms have been contacted regarding their advertising campaigns.

Commercial Wholesale Bakeries

The commercial wholesale bread market can be segmented into the following categories:

- Super premium
- Premium
- Popular
- Private label

Top wholesale baking companies in 2002 are detailed in Appendix A.

Specialty Bread Segment

In addition, the specialty bread market has been a growing market segment. This segment can be broken into the following sub categories:

- Supermarket bakeries
- Full-line retail bakeries
- Specialty retail, wholesale bread bakeries
- Restaurants, bakery cafes, hotels, foodservice, etc.

Specialty breads are primarily purchased by couples with no children or whose children have left the home, young consumers with discretionary income, and consumers more than 45 years of age. This market segment is estimated to have had approximately $6 billion in sales in 1996.

In-Store Bakeries

Consolidation within supermarkets has led to increased dependence upon value-added operations such as in-store bakeries. Two major forces are credited by industry sources for increased consolidation and the trend toward supermarket in-store bakeries. Mass merchandisers and discounters are grabbing a larger market share of the retail food market. For example, Walmart Supercenters now number among the ten largest bakery operators. Many supermarkets feel they must have in-store bakeries to compete.

Second, supermarket companies are merging to survive. Consolidated supermarkets are relying upon perishable departments such as bakeries to maintain market share and establish a competitive position. The largest in-store bakeries are detailed in Appendix B.

In-store bakeries depend upon quality and variety to secure and maintain their customer base for specialty breads. Price points remain an issue with many in-store baking operations. Although some in-store operations market their loaves at premium prices (similar to retail bread bakeries) many price their products similar to bread in the grocery isle. In fact, industry sources documented in 1996 that the average price for a 1 pound crusty Italian bread was $1.46 as compared with $2.12, the average price for similar bread on the grocery isle.

Due to the need to cut expenses, some supermarkets also have come to regard bakery items as convenience purchases. Essentially this attitude leads in-store bakeries to price products as a commodity instead of a premium product. Some industry analysts sum it up by stating, some supermarkets treat in-store bakeries as a convenience rather than a destination.

These attitudes have led to an increase of popularity of other firms that offer specialty breads, deemed “category killers” by the supermarkets. It should be noted that “not all stores are alike” and some in-store bakeries approach baking as a “destination experience” and not a commodity product.

Bakery Cafes
European style bakery cafes entered the baking scene in the 1980s. By 1996, bakery café chain s with ten or more stores operated 2,000 units across the United States.

Specialty Retail and Wholesale Bakeries
Consumer demand for greater varieties took hold in the last decade with the rise in popularity of artisan style breads. Specialty wholesale bakeries such as Acme Bread (Berkeley, CA), Bread Alone (Boiceville, NY), and La Brea Bakery (Los Angeles, CA) have established themselves in the marketplace.

Retail Bread Bakeries
Retail bread bakeries such as Great Harvest Bread Company (Dillon, MT) have also established themselves in the specialty bread market. These firms rely heavily upon quality to receive premium prices, $2.50 up to more than $5.00 per loaf, for their products. According to Modern Baking (September, 1998), the four largest retail bread bakery chains were Great Harvest Bread Co., Breadsmith, Big Sky Bread Co., and Baker Street Artisan Breads operating more than 230 stores in 1998.

An interesting aspect of the specialty bread market is that greater bread sales do not appear to come at the expense of other in-store breads. Instead, customers appear to purchase both. Furthermore, most segments of the specialty bread market point to the need for consumer education as a major challenge for their industry.

Based on the attributes of buckwheat and grain amaranth derivatives (ie flour), the specialty bread segment appears to offer the largest market opportunity. Specifically within the specialty bread segment, full-line retail bakeries, and specialty retail/wholesale

bakeries appear to be market segments to target, with in-store bakeries being a third focus area.

Organic Opportunities
Within all of these segments and subcategories, consumers have made room for organic products as well as partial baked breads.

Bread Mix Manufacturers
From the perspective of sales of new ingredients such as buckwheat and amaranth the "baking mixes" industry cannot be overlooked as many bakeries purchase ingredients (such as additive packs containing whole grains) from these firms.

Market Growth
Superpremium is where the growth is in the bread category, and that is where Sara Lee Bakery Group's focus lies regarding new products, according to Matthew T. Hall, company spokesman. Citing data from Information Resources, Inc., Mr. Hall said the entire bread category is up 2.6% for the most recent 52 weeks. Popular bread (white bread) is down 3%; premium bread is up 1.7%; and super premium is up 8%, he added. Similar data was reported by other industry sources (as detailed in the following table).

Fastest Growth in the Premium and Superpremium Segments			
	Dollar Sales	Pound Sales	Ave. Retail Price/Lb.
	% change over one year ago		
Superpremium	10.2	8.4	$2.03
Premium	9.7	5.1	$1.44
Popular	8.3	(1.5)	$1.31
Private Label	3.4	(1.6)	$0.87
TOTAL	7.4	2.9	$1.22

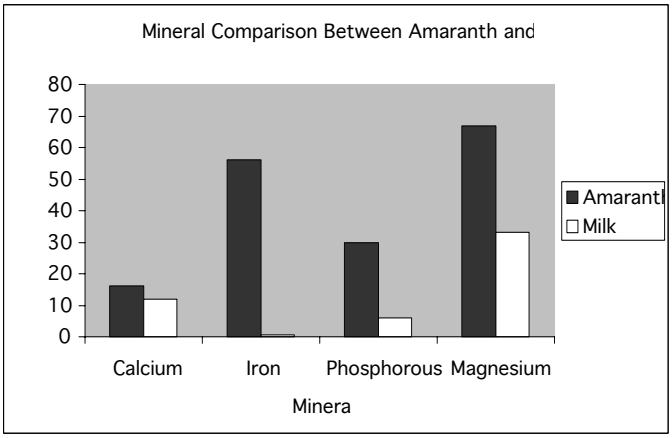
Even in the declining popular segment, firms are showing gains with brands that demonstrate nutritional qualities. Promising the fiber content of whole wheat bread and as much calcium in two slices as a glass of milk, IronKids (Sara Lee product) coheres with the trend toward enhanced health and nutrition.

Industry data indicates that sales of just in-store crusty breads (specialty breads) increased to $1.78 billion in 2002, a steady and significant increase.

Strategic Opportunities
Amaranth specifically has a number of properties that lend itself toward filling the niche of "functional foods" and the trend toward healthy products. Amaranth contains 14-16% protein. This is greater than the protein found in wheat (12-14%), rice (7-10%) and corn (7-10%). Amaranth contains all eight essential amino acids, (which must be obtained through consumption rather than synthesis) and is high in both lysine and methionine. Lysine is a limiting amino acid in wheat, corn and rice, but when amaranth is combined with these grains, a protein as complete as that found in fish, red meat or poultry is formed.

Amaranth has twice as much fiber as corn and oats and three times as much as wheat.

Amaranth provides a source of cholesterol-lowering agents such as fiber, linoleic acid and tocotrienols. Tocotrienols found in amaranth help the body fight aging, protect fatty areas of the body from damage by free radicals and may also help maintain heart health. Lysine contained in amaranth helps maintain and repair our body tissues.



Gluten-free: For those who cannot tolerate gluten in the diet (e.g. those with Celiac disease, etc.), amaranth provides a way to incorporate wheat-free products in the diet. High digestibility: Eighty-six to ninety percent of amaranth's protein is digestible.

Amaranth is also an excellent source of calcium, iron, magnesium and folate.

Buckwheat flour offers a similar healthy profile, although not to the same degree as amaranth flour. More detail is provided in this section on amaranth flour as less is knows by the general public.

The composition and production practices utilized to grow buckwheat and amaranth lend themselves to the growth areas of the breads market. Specifically, both crops can be grown organically with relative ease. In addition, amaranth specifically has an excellent nutritional profile. Both crops do not contain gluten and are options for those suffering from celiac's. Both products also offer a different taste and texture than wheat flour, although it is not determined if this a positive or negative marketing attribute.

As documented in the previous information, specialty bread bakeries depend upon quality, nutrition, and variety more than price points to attract and maintain customers. These market elements represent opportunities.

Future Work or Data Needs

Additional research and testing will need to be conducted on the functional properties of amaranth flour. More information is already known about the baking properties of buckwheat flour, however there is an information void for amaranth flour. In addition, nutritional enhancement and taste preferences will also need to be documented.

Top 88 Wholesale Baking Companies

Type of business (%):
RT: Retail supermarkets, convenience stores
FS: Food service (commercial and non-commercial establishments)
IS: In-store bakeries
CL: Club stores, mass merchandisers
TH: Thrift Stores

Rank 02	01	Company	Sales (in 000)	Plants	Employees	RT	FS	IS	CL	TH
1	N/A	General Mills	$13,500,000	21	29,000					
2	N/A	Kellogg Co.	$8,853,000	27	26,424					
3	1	Frito-Lay	$7,000,000 *	54	35,000					
4	2	Nabisco Biscuit Division	$3,850,000	9	14,800	73	2		25	
5	4	Grupo Bimbo, S.A. de C.V.	$3,703,339	63	72,400					
6	3	Interstate Bakeries	$3,496,482 *	62	34,000					
7	12	Sara Lee Bakery Group	$3,400,000 *	68	22,300					
8	5	Keebler Foods Co.	$2,700,000 *	18	13,200					
9	N/A	George Weston Bakeries	$1,800,000	13	9,000	80	5		10	5
10	8	Weston Bakeries Ltd./Ready Bake Foods	$1,400,000 *	27	3,600	60	15	25		
11	10	Flowers Bakeries, LLC	$1,100,000	26	5,000	65	18		12	5
12	11	McKee Foods Corp	$900,000	3	5,450					
13	13	Pepperidge Farm	$700,000	8	4,300	92	1		7	
14	14	Bimbo Bakeries, USA	$600,000	5	3,000					
14	N/A	Chef Solutions	$600,000	7	3,600					
14	16	Dawn Food Products	$600,000	10	2,000					
17	16	Rich Products Corp.	$575,000	4	7,000					
18	15	Mrs. Smith's Bakeries, LLC	$573,000	4	2,700	54	30	16		
19	30	Northeast Foods	$520,000	18		40	48		10	2
20	16	Canada Bread Co., LTD	$500,000 *	15	3,000					
20	16	Mission Foods	$500,000 *	10	3,552					
22	21	Lance	$450,000	4	4,700	40	40		20	
23	23	Stroehmann Bakeries LC	$396,000	8	3,000					
24	26	J & J Snack Foods Corp	$352,000	5	2,300					
25	24	Interbake Foods Inc	$350,000	9	3,500					
26	25	Christie Brown & Co.	$331,000 *	5	2,500					
27	27	Multi-Marques	$320,000 *	15	2,500					
28	N/A	Otis Spunkmayer	$265,000	4	1,300					
29	28	Tasty Baking Co.	$255,000	2	1,000					
30	29	United States Bakery	$245,000 *	6	3,000					
31	31	Lewis Bros. Bakeries	$235,000	7						
32	31	Utz Quality Foods	$215,000	3	1,750	81	2		15	2
33	32	Tom's Foods	$210,000 *	5	1,600					
34	33	Alfred Nickles Bakery	$200,000	3	2,200					
34	33	Edwards Fine Foods	$200,000	4	1,100	24	60	14	2	
34	N/A	Maplehurst Bakeries	$200,000	5	630					
34	52	Parmalat Bakery Division	$200,000 *	5	815					
34	39	Snyder's of Hanover	$200,000	2	1,000					
39	37	Country Home Bakers	$170,000	4	800					
40	38	Krispy Kreme Doughnut Corp	$166,630	218						
41	40	Bridgeford Foods Corp	$156,000	4	800					
42	N/A	Biscuits Leclerc	$153,000	4	400					

Rank 02	01	Company	Sales (in 000)	Plants	Employees	RT	FS	IS	CL	TH
43	42	Alpha Baking Co.	$135,000	3	950	24	70		5	1
44	43	Tyson's Mexican Original	$130,000	4	1,100	3	97			
44	43	Wegmans Food Markets	$130,000	1	250					
46	45	Schwebel Baking Co	$127,000	4	1,400					
47	41	The Barnes Companies	$126,000 *	5	650					
48	46	LePage Bakeries	$125,000 *	3	530					
49	52	D.F. Stauffer Biscuit Co.	$120,000	5	700					
50	50	La Madeleine	$107,000	1	2,500					
51	58	Vista Bakery	$104,000	2	600					
52	22	Maple Leaf Bakery	$100,000 *	2	3,088					
52	52	McGavin Foods Ltd.	$100,000	5	1,000					
52	N/A	Newly Weds Foods	$100,000 *	4	750					
52	48	Schmidt Baking Co	$100,000 *	2	875	74	11.5		12	2.5
52	52	Schulze & Burch Biscuit Co.	$100,000 *	2	500					
52	N/A	Wyandot	$100,000 *	2		78	17		5	
58	57	Perfection Bakeries	$99,000	6	1,050	57	15		25	3
59	47	Ben's Ltd.	$90,000 *	2	650					
59	58	Mondo Baking	$90,000	1	350					
59	52	Pan-O-Gold Baking Co.	$90,000	3	850	70	20		9	1
62	60	Health Valley Co.	$85,000	1	320					
63	61	Dough Delight Ltd.	$80,000	6	650					
64	51	Via de France Yamazaki	$77,000	7	620	10	80	5	5	
65	62	Crackin Good Bakers	$76,000	1	303	100				
66	63	Awrey Bakeries	$75,000	1	450	7	90			3
67	64	Klosterman Baking Co.	$68,000 *	4	750					
68	65	Gonnella Baking Co.	$67,500	3	360					
69	66	Butterkrust Bakeries	$65,000	1	365	65	13	5	15	2
69	66	Campagna-Turano Bakery	$65,000	3	450					
69	66	Eastern Bakeries Ltd.	$65,000 *	3	540					
72	80	Cottage Bakery	$64,000	1	275		5	95		
73	74	Cloverhill Bakery	$60,000	1	100	50	40		10	
73	69	Gourmet Baker	$60,000	4			35	55		
75	70	Mid South Bakeries	$55,000	3	300		100			
75	N/A	Snyder of Berlin	$55,000	1	340					
77	49	Fresh Start Bakeries	$53,796 *	5	311					
78	71	Giant Foods	$53,160	1	350					
79	73	New Bakery Co. of Ohio	$53,000	2	360		100			
80	72	Lucerne Foods	$52,000	2	220					
81	74	Freund Baking Co.	$50,000	3	275	5	95			
81	74	McGlynn Bakeries LLC	$50,000	1	400					
81	74	Parco Foods LLC	$50,000	1	300					
81	74	Ralphs Grocery Co.	$50,000	1	300					
81	16	The Kroger Co.	$50,000 *	7	2,750					
86	74	Meyer's Bakeries	$44,000	4	750	30	30	30	10	
87	83	John Donaire Desserts	$37,000	2	160					
88	N/A	Ottenberg's Bakers	$35,000	2	300					
88	84	Penny Curtis Baking Co	$35,000	1	200	100				

* Bakery Estimate

Source: ***Bakery Redbook, July 2002***

Top 50 In-store Bakeries

Rank	Chain	Headquarters	Number of In-store Bakeries*	Primary Production Method
1	Winn-Dixie Stores	Jacksonville, FL	1,156	Bake-off
2	Safeway	Pleasonton, CA	1,132	Scratch-mix
3	Food Lion	Salisbury, NC	1,041	Bake-off
4	Kroger Supermarkets	Cincinnati, OH	952	Bake-off
5	Albertson's	Boise, ID	891	Thaw-set/bake-off
6	Great Atlantic & Pacific Tea	Montvale, NJ	716	Bake-off
7	Publix Supermarkets	Lakeland, FL	565	Scratch-mix
8	Wal-Mart Supercenters	Bentonville, AR	520	Scratch-mix
9	Lucky Stores	San Leandro & Buena Park, CA	354	Bake-off
10	Supervalu	Eden Pairie, MN	300	Bake-off/scratch-mix
11	Ralph's Grocery	Los Angeles, CA	295	Bake-off
12	Von Cos.	Arcadia, CA	274	Bake-off
13	BI-LO	Mauldin, SC	236	Bake-off
14	Tops Markets	Williamsville, NY	227	Bake-off
15	H.E. Butt Grocery	San Antonio, TX	213	Bake-off
16	Fleming Cos.	Oklahoma City, OK	208	Bake-off
17	Costco Co. (US)	Kirkland, WA	200	Scratch-mix
18	Ingles Marekts	Black Mountain, NC	181	Bake-off
19	Marsh Supermarkets	Indianapolis, IN	180	Bake-off
20	Jewell Food Stores	Melrose Park, IL	177	Bake-off
21	Stop & Shop	Quincy, MA	167	Bake-off
22	Giant Eagle	Pittsburgh, PA	166	Bake-off
23	Hy-vee Food Stores	Des Moines, IA	157	Scratch-mix
24	Acme Markets	Malvern, PA	154	Bake-off
25	Smith's Food & Drug	Salt Lake City, UT	153	Bake-off
26	Hannaford Bros.	Scarborough, ME	150	Bake-off/thaw-sell
27	Giant Food	Landover, MD	149	Scratch-mix
28	Grand Union	Wayne, JN	145	Bake-off
29	Weis Markets	Sunbury, PA	143	Scratch-mix
30	Harris Teeter	Matthews, NC	142	Bake-off
31	Jitney Jungle Stores	Jackson, MS	131	Bake-off
32	Bruno's	Birmingham, AL	127	Bake-off
33	Shaw's Supermarkets	East Bridgewater, MA	126	Bake-off
34	Fred Meyer	Portland, OR	118	Bake-off
35	Randall's Markets	Houston, TX	116	Bake-off/Scratch-mix
36	Meijer	Grand Rapids, MI	113	Scratch-mix
37	Sam's Wholesale Club	Bentonville, AR	111	Scratch-mix
37	Pathmark Supermarkets	Woodbridge, NJ	111	Bake-off
38	Railey's/Bel-/Air	Sacramento, CA	108	Scratch-mix/bake-off
39	Brookshire Grocery Co.	Tyler, TX	104	Bake-off/thaw-sell
40	Super Kmart Centers	Troy, MI	102	Scratch-mix
41	Dominick's Finer Foods	Northlake, IL	99	Bake-off
42	Kash -n Karry Food Stores	Tampa, FL	97	Bake-off
43	BJ's Wholesale Club	Natick, MA	94	Bake-off/Scratch-mix
44	Eagle Food Centers	Milan, IL	87	Bake-off
45	Schnuck Markets	St. Louis, MO	85	Bake-off
46	Food Giants Supermarkets	Sikeston, MO	82	Bake-off
47	Minyard Food Stores	Coppell, TX	77	Scratch-mix/bake-off
48	Big Bear Stores	Columbus, OH	74	Scratch-mix
48	Giant Food Stores	Carlisle, PA	74	Scratch-mix
48	Stater Bros.	Colton, CA	74	Bake-off
49	Save Mart Stores	Modesto, CA	73	Bake-off
49	King Soopers	Denver, CO	73	Bake-off
50	Basha's Markets	Chandler, AZ	71	Scratch-mix
50	Price Chopper Supermarkets	Schenectady, NY	71	Bake-off
			13,742	

Appendix B

Cereal Industry Overview

Industry Analysis

Breakfast cereal is a staple item for consumers. Whether hot or cold, it makes its way onto grocery lists and gets people into grocery stores. The recent media attention on the nutritional value of breakfast has played a large role in expanding the industry. Many consumers are following the trend trying to improve their child's school performance by feeding them breakfast. Ready to Eat (RTE) cereal encourages the trend by providing a breakfast solution that is easy and convenient.

Business sector
Most nutrition experts will agree that while cereals high in refined grains and sugars are popular with segments of the population, whole grains offer nutrients, trace minerals, and fiber that can help protect against cancer, heart disease, and diabetes. Cereal grains are a natural source of essential B vitamins, iron, zinc and vitamin E. Cereal lipids can also be rich in the essential fatty acid, linoleic acid.

Processing can destroy valuable nutrients in cereals. When utilizing a whole grain, the unsaturated fat located in the endosperm can cause rancidity. Innovative Grain Technologies (IGT) in Lincoln, NE inactivates the lipase enzymes that could cause rancidity. By denaturing enzymes, shelf life is extended. Other manufacturers separate the various parts of the grain to avoid rancidity and then recombine them after lowering the unsaturated fat content.

Roasting the grains also helps impart a better flavor. Roasted flavors are popular in cereals, snack mixes, and other foods. Companies utilize a dry roasting system to maximize the nutrient content and reduce the microbial load of the raw grains. IGT uses a patented infrared process for their dry roasting.

Fiber is a very important nutritional component of today's breakfast cereal. Recent studies indicate a link in fighting several diseases including cancer, diabetes, digestive disorders, heart disease, and obesity.

Industry sector
Costs of Production

ESTIMATES OF PRODUCTION COSTS[1]			
	Item $/lb	% of mfr price	% of retail price
Manufacturer Price	2.40	100.0	80.0
Manufacturing Cost:	1.02	42.5	34.0
Grain	**0.16**	**6.7**	**5.3**
Other Ingredients	0.20	8.3	6.7
Packaging	0.28	11.7	9.3
Labor	0.15	6.3	5.0
Manufacturing Costs	0.23	9.6	7.6
Gross Margin		57.5	46.0

Participants

Traditional Cereal Manufacturers

The industry leaders in the traditional RTE market are: Kellogg's, General Mills, Post, Quaker Oats and Malt-O-Meal. Private label brands are beginning to have a significant presence in the industry thanks to price conscious consumers.

Organic Market Leaders

Mother's Natural Foods This division of The Quaker Oats Co. has seven flavors of all-natural cold cereal that are natural grain-based and sweetened with molasses and/or honey. Most are also low fat and cholesterol-free. Two recent additions target the growing kid's area--Peanut Butter Bumpers and Groovy Grahams. Mother's also has seven varieties of hot cereals; its oat products carry the "healthy heart" label.[2]

Hain Celestial Group Hain markets a number of organic and natural cereal brands under the Health Valley brand. One top seller is Soy-O's, a soy-fortified cereal with organic oat flour that comes in three flavors.

U.S. Mills There are four brands of cereal under the U.S. Mills banner. Uncle Sam cereal is an all-natural, wholegrain wheat flake mixed with flax seed. Introduced in 1908, this is the oldest all-natural cereal on the market. New Morning is an organic cereal line with 16 products including Oatios and GinkgOs. Erewhon is also an organic line with 21 varieties including Kamut Flakes and Apples Stroodles. Finally, U.S. Mills Naturals has six all-natural cereals such as Wafflers and Cocomotion.[3]

Barbara's Bakery Barbara's Bakery offers seven types of shredded cereals including Shredded Spoonfuls and Bite Size Shredded Oats, and six varieties of frosted cereals (sweetened with unsulphured molasses and honey or dehydrated cane juice). Its most recent addition is OrganicGrainShop, a high fiber cereal medley.

The New Organics Co. Four varieties of high-fiber, low-sodium, and low/no-fat organic cereals are made by New Organics. It also has a line of kid's cereal under its Richard Scarry line of kid's foods.

Nature's Path Nature's Path offers 22 cold cereals that are certified organic and GMO-free. It also has the LifeStream line of cereals, which are not 100% organic, but contain organic ingredients and are also non-GMO. "It's our transitional line that's not quite 100 percent organic," Neuman said. Its most recent introductions were the Enviro Kids cereals. These certified organic cereals come in four flavors that each center on an endangered species such as Koala Crisp or Gorilla Munch. The back of each box has two columns, one about the featured animal and the other about organics. The cereals use organic cane juice and barley malt as sweeteners. Enviro Kids cereals are also wheat-free and gluten-free.[4]

*Kashi Co***.** (division of Kellogg) Kashi is an all-natural cereal made with seven grains and sesame. Good Friends is a high fiber cereal and the most popular cereal in Kashi's line, according to Andres Aussie, senior vice president of sales and marketing. One unique

cereal is Kashi-Go, a hot breakfast cup pre-cooked with fruit juice. "It is vacuum-packed and shelf stable," Aussie said. "It's ready to peel and eat, or heat in the microwave."[5]

Market share distribution

Kellogg's	32%
General Mills	31%
Post	16%
Quaker Oats	9%
Private Labels	8%
Malt-O-Meal	3%

(Figures rounded to the nearest point.)

General Mills has picked up the most market share (+3%) in the past 3 years, at the expense of Private Labels (-2%) and Kellogg's (-1%). Shares based on $7.6 Billion in supermarket sales in 1998.[6]

Competitive position

Consumers have significant impact on the cereal industry. Cereal is typically purchased weekly, a few boxes at a time. It is easy for a consumer to switch back and forth between brands. Additionally, grocery stores are in control of shelf space, not the cereal manufacturers.

Another large potential threat to the cereal industry is the power of the suppliers. The suppliers have power as cereal ingredients (sugar, food grains, and flour) have few substitutes. It would be almost impossible for a cereal manufacturer to enter the grain or sugar industries. The volume of imported sugar, advertising, and packaging suppliers also are influential.

Advertising is the single largest source of marketing for cereal companies. This gives them price control. The major players spent $762 million on advertising per day in 1993.[7] Such advertising has also provided brand recognition that can crush a smaller company trying to create and market a new cereal.

Technology is also a barrier to entry in the market. Although the fundamentals of production are simple and well known, granulating, shredding, flaking, puffing, and extrusion processes require production experience. A typical plant will produce $400 million of output annually, employ 800 workers, and will require an initial investment of $300 million.[8]

Strategic opportunities

Manufacturers have opportunities to add value by utilizing specialty grains. These new grains can add new textures, colors, flavors, and increased health benefits. Current examples of new grains include bulgur wheat, flaxseed, and sprouted grains.

Bulgur wheat is a nutty flavored grain that is a staple in Middle Eastern diets. In the United States, bulgur wheat is gaining popularity in vegetarian diets for salads, side dishes and entrees. The high fiber and carbohydrate content make it ideal for a Mediterranean diet as well.

Bulgur wheat is so named for its processing. Whole wheat is steamed to partially cook and gelatinize the starch. During the cooking process, the grain begins to hydrate, moving nutrients from the outer bran layer into the kernel. The granules of starch open during cooking, and then close partially during drying. The grain is then ground into particles and sifted. Sunnyland Mills in Fresno, CA has succeeded recently in making puffed bulgur product similar to oatmeal.

Flaxseed, or linseed, is typically added to cereals as a nugget to improve texture. Flaxseed is gaining in popularity because it contains all eight essential amino acids and twice the total dietary fiber of oat bran. 57% of the fat from flaxseed is omega-3, more than any other plant derived oil. Researchers have found that a diet rich in flaxseed lowers serum cholesterol and triglyceride levels significantly.[9]

IGT manufactures whole flaxseed for ready-to-eat (RTE) cereals. The company states that despite the high oil content (38%) flaxseed is still very nutritious.[10] Processing also increases its value as an additive, as the cooking process improves the flavor.

Sprouted grains are an ancient technology now coming to the forefront in manufacturing. Through the sprouting process, nutrients become more bioavailable and are easier to digest. Sprouted and kilned wheat products can be used in formulating cereals for those with special dietary needs like infants, the elderly, or athletes. Sprouted or kilned wheat flakes, wheat nuggets, meals, and flours can also help reduce company costs by decreasing the amount of sweetener used in formulations.

Market Analysis

Food scientists have been trying for years to 'build a better breakfast cereal.' The major obstacle is designing a nutritious, highly palatable product at a consumer friendly price. Much of the recent focus has been on traditional ingredients (corn, wheat, rice, oats, and barley) with new-found health benefits. Some manufacturers have even been fortunate enough to obtain FDA approved health benefits associated with these ingredients for labeling purposes.

Market Trends

American Breakfasting Habits[11]	
Bowl of cereal 49%	
Toast	30%
Eggs	28%
Coffee	28%
Hot cereal	17%
Pancakes, Sausage, Bagels, French toast	<10%

Despite the demographics, the recent trend in breakfast eating is still moving downward. The cold cereal market has gone from $8.02 billion in sales in 1993 to $6.99 billion in 1998.[12]

Market Segmentation

The cereal industry has felt a marginal impact from products such as Pop-Tarts and breakfast bars. Hot cereals were able to enter the market to satisfy consumers looking for healthier choices. This lack of potential competitors is what gives the present cereal companies power. They are able to take advantage of absolute cost advantages and economies of scale.

Strategic Opportunities

Specialty Crops have the most opportunity in the cereal market as an ingredient substitute. The major areas to address are formulation, flavor and shelf stability. Included in these areas is fiber, as previously addressed, and starch.

Starch is a key factor in RTE cereals to increase bowl life, making any crop high in amylose starch is desirable. Additionally, specialty starches improve texture in puffed, extruded products. Starches can also be used to replace the sugar or fat coating that help adhere fruit bits, nut pieces, etc. to cereals. Perhaps, grain amaranth or other crops could satisfy these processing requirements.

Future Work

Work needs to be done to establish fiber, fat, protein and starch components of specialty grains. Ideally, becoming an ingredient substitute for a major cereal company is the best route. Additionally, an organic/natural cereal manufacturer is more likely to utilize a specialty crop product. However, cereal manufacturers are going to pick the cheapest, most consistently available product. Until specialty crops become more common, and processing more available, the challenges seem almost prohibitive.

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Pasta Industry Overview

Industry Analysis

In 2001, 88% of all households purchased dry pasta. This indicates that the majority of the U.S. population is being exposed to pasta at least once a year. Additionally, this high percentage indicates a wide exposure of pasta products and acceptance in the typical American diet. According to ACNielson, the average pasta consumer buys pasta every 37 days and spends only $1.65 at each occurrence. One of two conclusions can be drawn from these statistics:

a) The volume of pasta purchased per consumer per month is extremely low.
b) The pasta purchased by the consumer is of a low or generic quality due to $1.65/purchase.

Business sector
According to the National Pasta Association, Northeasterners are the most likely of any region to consume pasta on a weekly basis (84%). Southerners are less likely to consume pasta on a weekly basis with an average of only 70%, although consumption has risen 42% in the last five years. In the West and Northeast regions, one in five residents serve pasta three or more times per week.

These increases in pasta consumption are without a doubt due to the increase in Americans wanting a more health conscious diet. A recent survey done by the American Pasta Association shows that 44% of the health conscious are consuming more pasta than they were five years ago. In the short run, this trend could reflect a negative impact from the Atkins' Diet and low-carbohydrate foods movement.

Market share distribution
Of the two leading Pasta brands: Barilla with13.8% market share, and Ronzoni with 8% market share; neither brand utilizes alternative pasta ingredients. Both of these leading competitors produce only Durum Wheat pasta and egg noodle pastas. With neither of these major manufacturers carrying pasta products with alternative grains, it is difficult to estimate the potential sales of such a large industry presence. In an effort to defray risk, other minor brands owned by either company could incorporate Buckwheat and Amaranth and start a specialty pasta line quite successfully as a test marketer.

Strategic opportunities
Pasta can successfully be marketed as a health food as it contains large amounts of B vitamins, iron and folic acid. Most of these nutrients come from Durum Wheat which also makes a firm pasta product. However, Amaranth and Buckwheat are great substitutes for food processors trying to appeal to health-conscious consumers. Amaranth is high in fiber and protein. Its amino acid profile is well balanced and high in lysine, an amino acid in which most grains are deficient. Buckwheat is relatively high in protein and low in fat as well. Other positive attributes are the abundant amounts of potassium, magnesium, phosphate and iron found in Buckwheat. These nutritional qualities should give products made from amaranth and buckwheat flour extra appeal to health conscious consumers.

Market Analysis

For both Amaranth and Buckwheat to be accepted as a new pasta type, it is important that these grains be able to fill the gap in taste over the traditional Durum Wheat pasta. As it is unlikely that Buckwheat and Amaranth will enjoy the market share that Durum Wheat has, these grains will need to be marketed as specialty pasta. In order to be niche marketed, these specialty pasta products will have to become satisfactory replacements in America's most popular dishes. According to the *American Pasta Report,* 40% of the respondents said their favorite pasta types was long spaghetti, lasagna was at 12%, with elbow macaroni, fettuccine, linguine, rotini, and angel hair all being below 6%. Amaranth and Buckwheat are currently marketed on a small scale as some of these types of pastas.

Strategic Opportunities

In conclusion, Buckwheat and Amaranth are going to be most successful when niche marketed. Utilizing these grain products as specialty pastas with their significant number of nutritional advantages of protein quality, fiber content, amino acid profiles and folic acid amounts could potentially fill the need of consumers in today's market place.

Future Work

Research needs to be done on both grains to determine their ability to comply with industry standards of firmness and palatability. Further industry analysis should be completed on ingredient pricing and willingness of the consumer to purchase a premium priced pasta product.

Flour Milling Industry Overview

Industry Analysis

Rising interest of consumers in healthy, high-quality grain-based food products represents a unique opportunity for the milling industry to process grain amaranth and buckwheat into flour for use in breads, breakfast cereals, pastas, and other foods.

General Description

Industry Sector

As of 1996, there were 354 mills in operation, primarily located in Kansas, New York, Minnesota, Ohio, California, and Missouri. Con-Agra was the leader, milling 27 million pounds per day in 27 facilities across 14 states, followed by Archer Daniels Midland, and Cargill. The industry employed 12,300 workers, a drop of 1,000 since 1993; these workers were paid $12 per hour on the average.[1]

Following the trend in the overall food industry, milling concentration has increased over the past several years. In the years 1973-1990, milling capacity rose 70%, while the number of mills decreased 25%. This trend continued with mild declines in the number of mills throughout the 1990s. More than one-half of U.S. milling capacity is concentrated in operations with daily capacities in excess of one million pounds. The move toward consolidation is driven by three goals: decreased labor costs, decreased transportation costs (it costs less to ship raw grain than processed flour), and increased profit.[2]

Participants

Amaranth and buckwheat are viable alternatives to wheat for millers, both large and small. The largest milling companies, ADM and Con-Agra, already have specialty lines of products. Flours made from amaranth or buckwheat would enhance the diversity of their product lines. Smaller millers and even new entrants also stand to benefit by processing amaranth and buckwheat into flour. Such differentiation from the competition could potentially result in an advantage over larger competitors in niche markets, for example, as suppliers of high quality flour to health food manufacturers.

Market Analysis

Grain-based foods are more popular today than ever before among American consumers. Statistics from the *Encyclopedia of American Industries* indicate that from 1970-1994, per capita flour consumption has risen 69 pounds to 179.7 pounds.[3] Additionally, the U.S. Department of Commerce states that U.S. flour consumption exceeded 400 million cwts. for the first time ever in 1996.[4] The increase in flour consumption is strongly correlated to the rise in the popularity of fiber, bran, and whole grain products and convenience foods like pizza and sandwiches.[5] In spite of the increased consumption of grain-based foods, Americans are still consuming about 2 servings less of these foods than is recommended by the USDA's Food Guide Pyramid. If Americans followed the Food Pyramid, flour consumption would rise to 185 pounds per person annually.[6] Such an increase would improve market opportunities for new products made from alternative grains such as grain amaranth and buckwheat.

Market Trends & Growth

According the U.S. Census Bureau's Annual Survey of Manufactures, growth in the value of product shipments in the grain-based foods industry was 7.6% during the 1997-2000 time period compared to only 3% in the entire food manufacturing industry. The industry was led by the retail baking and breakfast cereal industries, which posted increases of 34.4% and 21.3%, respectively. The flour milling sector was down 23.4% over the time period.[7]

Value added by manufacture rose 39.7% for retail bakeries and 13.4% for flour milling. By this measure, the grain-based food products sector also outperformed the food industry as a whole, which only saw a growth of 12.1% in the value added by manufacture.[8]

Costs of materials and ingredients fell during the same time period by 26.1% in the flour milling sector.[9] However, this trend may turn around in the months to come as milling companies face the effects of a short wheat crop, causing higher prices. This could be beneficial to amaranth and buckwheat. Even though amaranth and buckwheat will still cost more to milling companies, higher wheat prices will narrow this gap, making these grains more viable.

Strategic Opportunities

Food processors are rushing to capitalize on consumer spending trends toward better-for-you foods. Amaranth and buckwheat demonstrate a potential to be more appealing to consumers following this trend than wheat. The grains are most likely to be successful with consumers when blended into multi-grain foods. Studies indicate that amaranth can be blended at levels of 50-75% with other flours without a negative impact on taste.[10] Buckwheat flour is primarily used in ethnic foods and exported goods specifically Japanese "soba" noodles, but also has use in American buckwheat pancakes.[11] Opportunities exist for expanding consumer use of these flours because the interest in healthier foods continues to be strong.

Market Needs & Future Work

The milling industry has already begun to address the consumers demand for healthier foods by investing in the development of new products, such as General Mills' Sunrise Organic cereal products, launched in March 1999.[12] Amaranth and buckwheat are great

substitutes for wheat for food processors trying to appeal to health-conscious consumers. Amaranth is high in fiber and protein. Its amino acid profile is well balanced and high in lysine, an amino acid in which most grains are deficienct.[13] Buckwheat is relatively high in protein and low in fat as well.[14] These nutritional qualities should give products made from amaranth and buckwheat flour extra appeal to health conscious consumers.

Interest by consumers in alternative grain-based products may be fueled by the charge that flour performance has diminished over the past several years. This apparent drop in quality is evident in the drop of protein in wheat as well as the decline in the quality of its protein. Reasons for this could include wheat breeding programs emphasizing higher per acre yield rather than the quality of the end product, an increase in the number of available wheat varieties, and the use of irrigation and fertilizer on wheat.[15] Buckwheat and amaranth address these concerns because of their high quality and high protein content. Additionally, the fertilizer and water needs of these two crops are modest, compared to other crops.

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Appendix C

RESEARCH REPORT

EVALUATION OF AMARANTH IN BAKERY PRODUCTS

Submitted to:

Mr. Alan Weber
Thomas Jefferson Agricultural Institute
601 West Nifong Blvd., Suite 1D
Columbia, MO 65203

Submitted by:

Brian L. Strouts
Head of Experimental Baking
American Institute of Baking
1213 Bakers Way
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Manhattan, Kansas 66505-3999

January 5, 2004

EVALUATION OF AMARANTH IN BAKERY PRODUCTS

INTRODUCTION

The American Institute of Baking (AIB) was contacted by Mr. Alan Weber, Thomas Jefferson Agricultural Institute, with the request to evaluate the use of amaranth in bakery products. Mr. Weber visited AIB to discuss the use of this grain and a project to develop application formulations. A project proposal was submitted to Mr. Weber on April 28, 2003. Further communications with Mr. Weber added to the project scope and a revised proposal was requested.

OBJECTIVE

The objective of this project was to evaluate the use of amaranth in bakery products by developing application formulations for two products, and provide basic analytical testing data on the amaranth flour compared to wheat flour.

MATERIALS AND METHODS

The Thomas Jefferson Agricultural Institute supplied the amaranth used in the testing. All other ingredients included those commonly used in bakery products and were supplied by AIB.

Two products were developed with the incorporation of amaranth flour into the formulations. A whole grain bread was formulated with the use of amaranth flour in addition to the flour and grains typically used. Amaranth was added at levels of up to 20% replacement of the wheat flour in the formulation. Other formulation and processing adjustments were made to enhance the performance of the amaranth in this

application. The second product was a gluten free baked good. Available literature was reviewed to find a suitable starting formulation. Amaranth flour was then added at a minimum level of 10% on a total percent basis.

Analytical testing was conducted on the amaranth and wheat flours used in the product testing. Testing included: moisture content, protein content, ash content, amylase activity (as determined by falling number), starch damage, particle size (as determined by Alpine sieve), and Farinograph (to determine water absorption, and mixing tolerance).

RESULTS AND DISCUSSION

With the addition of the Amaranth flour to the bread dough formulation it was necessary to increase the added vital wheat gluten (for added structure) and increase the total water (for the added absorption of the Amaranth) (Table I). Sponge characteristics were slightly too wet, but dough characteristics recovered with the resting time in the process (see the Score Sheet in the Appendix).

Although the quality scores of the bread made with added Amaranth are slightly lower compared to the control we did not judge the differences as extreme or very different until the 20% addition level (Appendix and Figure 1). The use of Amaranth at 5, 10, or 15% all seemed comparable to one another.

A gluten free banana bread formulation was developed with added Amaranth flour (Table II). The use of a combination of rice flour, corn and potato starch in conjunction with the Amaranth flour produced a finished product of good quality.

Analytical results on the flour and finished bread formulations are included in Tables III and IV. A sample of the Amaranth flour was also evaluated using a quantitative gluten allergen test. Gluten was not detected in the sample (test report in the Appendix).

Table I

Sponge and Dough
100% Whole Wheat Pan Bread Formula and Procedure

	Control	5% Amaranth	10% Amaranth	15% Amaranth	20% Amaranth
Ingredient	Bakers %	Bakers %	Bakers %	Bakers %	Bakers %
Sponge:					
Flour, coarse whole wheat	70.0	70.0	70.0	70.0	70.0
Amaranth	0.0	5.0	10.0	15.0	20.0
Yeast, compressed	2.5	2.5	2.5	2.5	2.5
Vital Wheat Gluten	4.0	8.0	8.0	8.0	8.0
SSL	0.5	0.5	0.5	0.5	0.5
Mineral Yeast Food	0.5	0.5	0.5	0.5	0.5
Water	46.0	53.9	55.6	57.3	59.0
Dough:					
Flour, fine whole wheat	30.0	30.0	30.0	30.0	30.0
Yeast, compressed	1.0	1.0	1.0	1.0	1.0
Shortening, unemulsified	3.0	3.0	3.0	3.0	3.0
Salt	2.0	2.0	2.0	2.0	2.0
High Fructose Corn Syrup	9.0	9.0	9.0	9.0	9.0
Nonfat Dry Milk	3.0	3.0	3.0	3.0	3.0
Calcium Propionate	0.12	0.12	0.12	0.12	0.12
Water	12.3	12.3	12.3	12.3	11.3

Procedure:

Mixer: Hobart A-120 mixer with McDuffee bowl and fork agitator.

Sponge: Mix the sponge ingredients for 1 minute at speed one.
Mix again for 1 minute at speed two.
Desired temperature of the sponge after mixing is 79°F ± 1°F.

Fermentation: Allow the sponge to ferment for 2.5 hours at 84°F in a covered container.

Dough: Place the dough ingredients in the mixing bowl and mix for 30 seconds at speed one.
Add the sponge and mix for 30 seconds on speed one.
Mix the dough at speed two to optimum gluten development (approx. 3').

	Desired dough temperature is 79°F± 1°F.
Floor Time:	Allow the fully mixed dough to rest for 10 minutes at 84°F in a covered container.
Scaling Wght:	18.5 oz. (524g) per loaf (2 loaves per batch).
Interm. proof:	Divided dough pieces should be allowed to rest for 10 minutes at room temperature.
Molder:	Straight grain
Proofing:	Place the molded loaves into bread pans and place in proofing cabinet at 110°F, 81.5% Relative Humidity. Allow the dough to rise to 90 mm total or to 5/8” above the top of the pan.
Bake:	22 minutes at 420°F
Pan:	Top inside: 9L x 4 7/16W x 2 3/4D

Table II
Gluten Free Banana Bread

Ingredient	True %
Part 1	
Amaranth	11.55
Granulated sugar	8.72
White rice flour	14.53
Potato starch	7.27
Corn starch	7.27
Xanthan gum	0.07
Salt	0.22
Cinnamon	0.10
Nutmeg	0.05
Baking powder	0.36
Baking soda	0.15
Part 2	
Eggs	7.27
Oil	4.36
Buttermilk	9.08
Vanilla	0.22
Banana flavor, #306110	0.15
Bananas	14.53
Water	11.55
Chopped nuts	2.54

Procedure:

Procedure: Dry blend Part 1. Add Part 2 ingredients and mix on low speed for 1 min. Scrape bowl and mix for 30 seconds more.
Scale: 750 g for loaf pan.
Bake: 350°F 46 min. for loaf pan.

Table III

Flour Analysis

Flour Analysis	Course Whole Wheat Flour	Fine Whole Wheat Flour	Amaranth Flour
Moisture (%)	13.40	12.35	8.40
Ash (14% MB) (%)	1.636	1.694	3.105
Protein N x 5.7 (14% MB) (%)	15.03	15.38	16.91
Falling Number (sec.)	430	465	65
Farinograph (14% MB)			
Peak (min.)	13.50	6.00	2.50
Tolerance (Stability) (min.)	17.00	8.50	2.50
Absorption (%)	64.70	71.20	80.3 (Approx.)
M.T.I. (BU)	20	40	60
Starch Damage (%)	2.54	2.95	23.62
Alpine Screen O/45 (%)	53.00	6.10	4.80
Alpine Screen O/100 (%)	20.40	38.80	36.20
Alpine Screen O/140 (%)	4.90	12.30	13.50
Alpine Screen O/200 (%)	4.60	10.80	12.50
Alpine Screen O/325 (%)	8.20	17.10	15.50
Alpine Screen T/325 (%)	8.90	14.90	17.50

Comments: Farinograph absorption is approximate because the absorption does not correct the same as a flour.

Absorption=Approximate

Table IV
Bread Analysis

Bread Sample	Water Activity	Moisture (%)
Control	.959	37.05
5% added Amaranth	.966	39.52
10% added Amaranth	.965	39.33
15% added Amaranth	.966	39.52
20% added Amaranth	.967	39.92

Appendix D

October 6, 2003

Brian Strouts
Head of Experimental Baking
American Institute of Baking
Research Department
1213 Bakers Way
Manhattan, KS 66502

Dear Brian Strouts,,

Below are the results of the quantitative gluten allergen testing done on the sample of Amaranth Flour (Thomas Jefferson Agriculture Institute 03-5-291) you submitted:

Sample	Results
Amaranth Flour	ND

Note: ND = Not detected. Level of detection = 20 ppm.

An invoice for this test will follow in a few days. If you have any questions, please contact me at (785) 537-4750 extension 156 or by e-mail at bglaser@aibonline.org. Thank you for allowing us to serve you.

Sincerely,

Bryan Glaser
Supervisor, General Laboratories

Note: The analytical results pertain only to the submitted sample and may not be construed as an endorsement of the sampling method employed.

AIB International
1213 Bakers Way • P.O. Box 3999 • Manhattan • KS 66505-3999 • 1-785-537-4750 • 1-800-633-5137 • FAX: 1-785-537-1493
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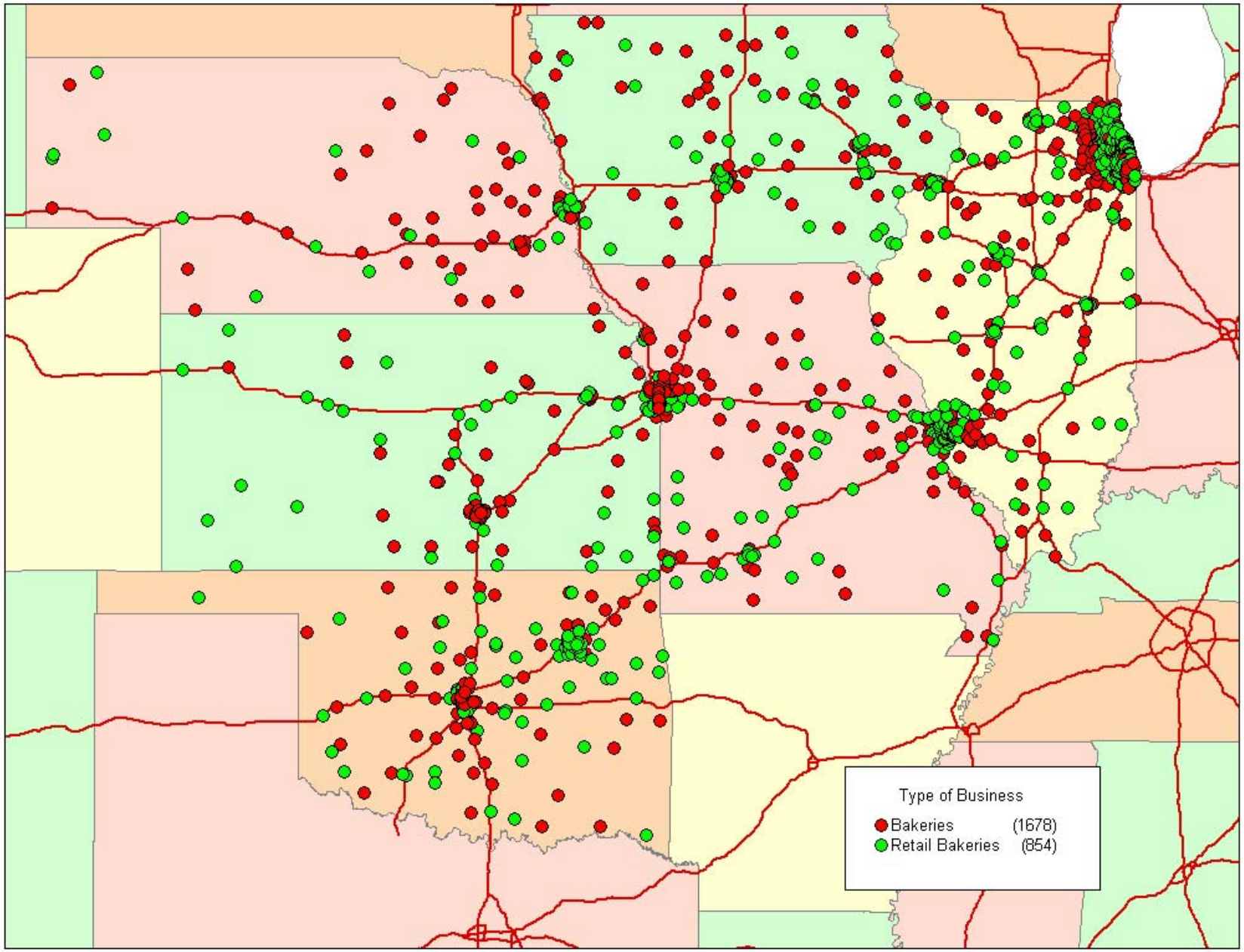
Appendix E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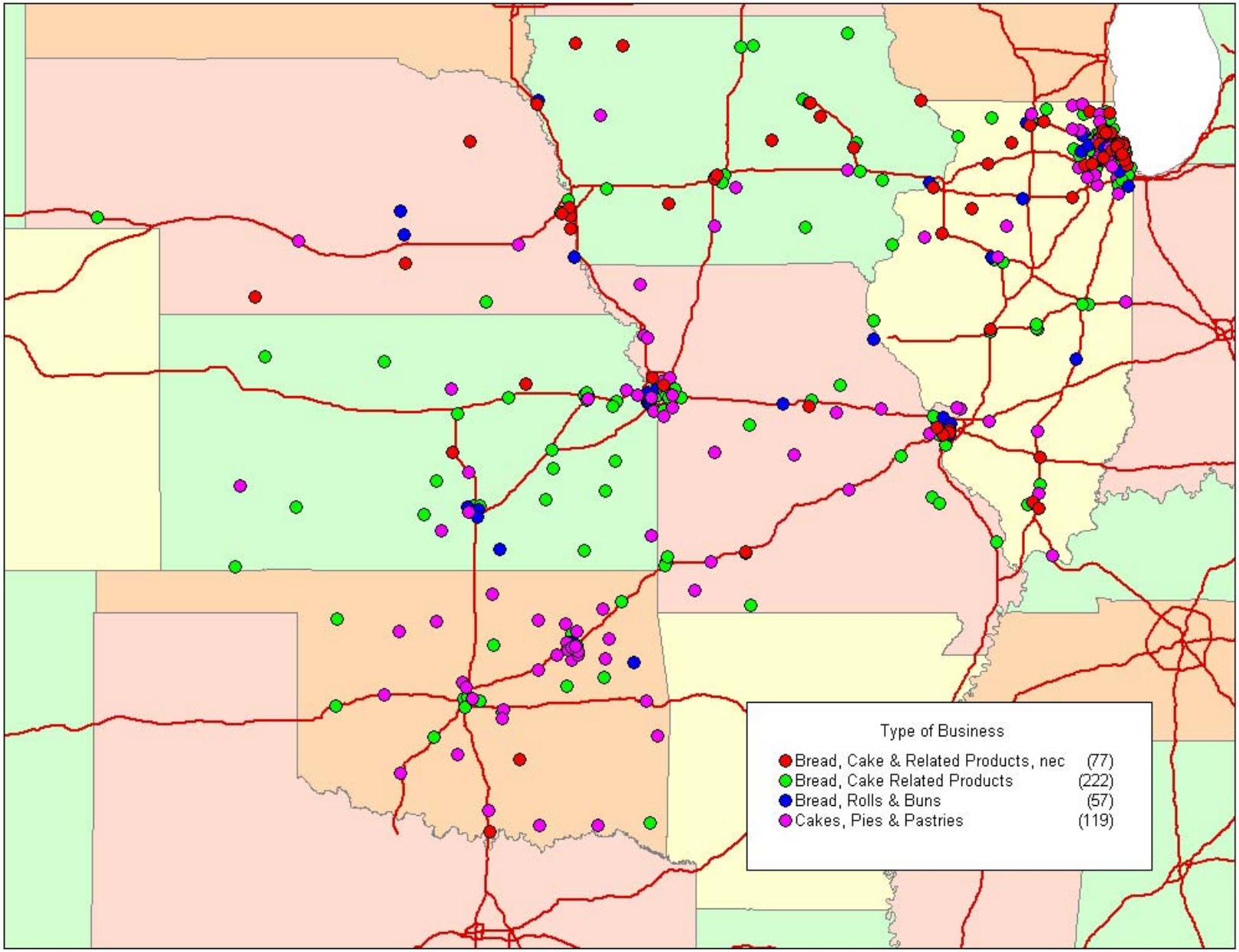
Retail Bakeries (854)


Type of Business
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Bread, Cake Related Products (222)
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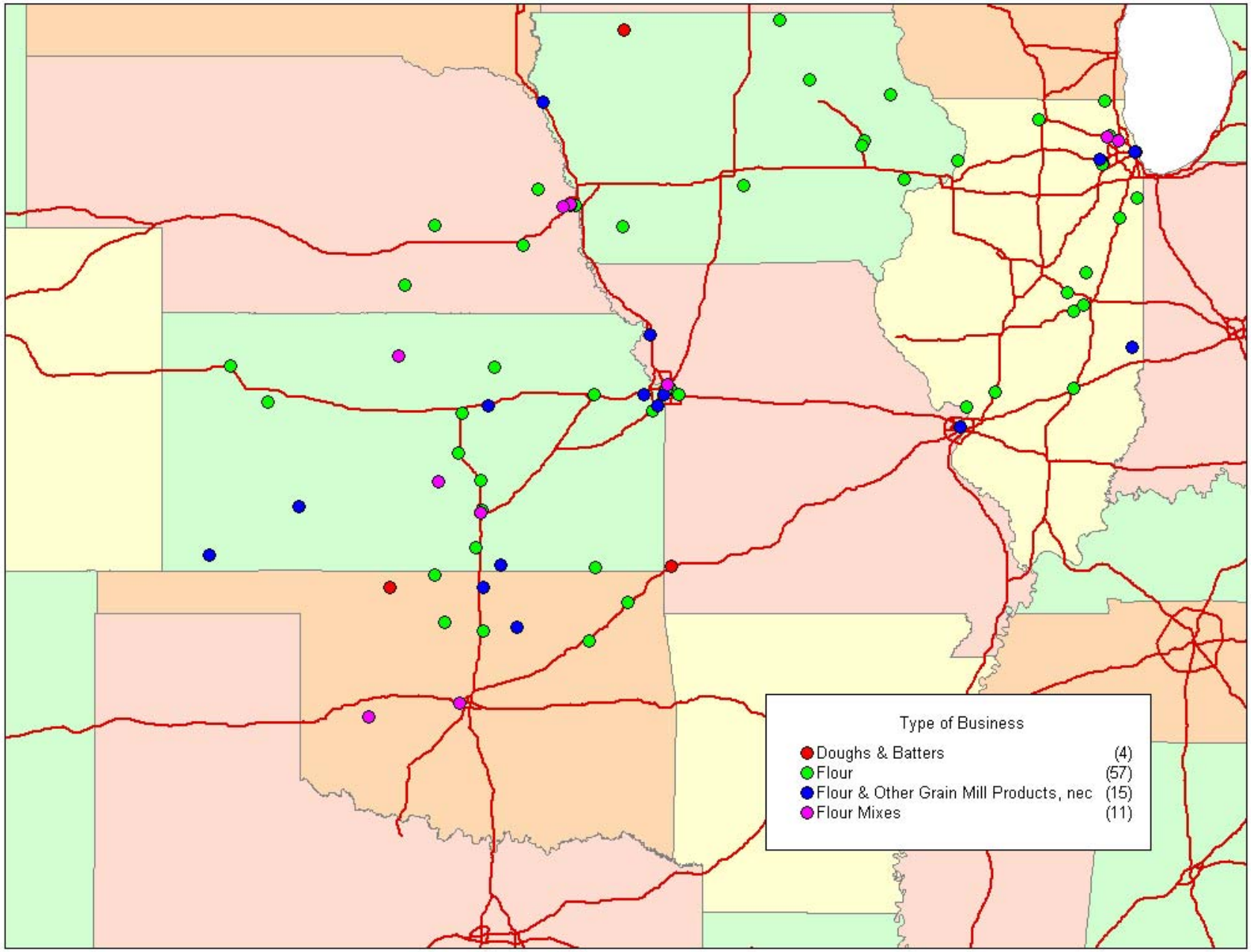
Cakes, Pies & Pastries (119)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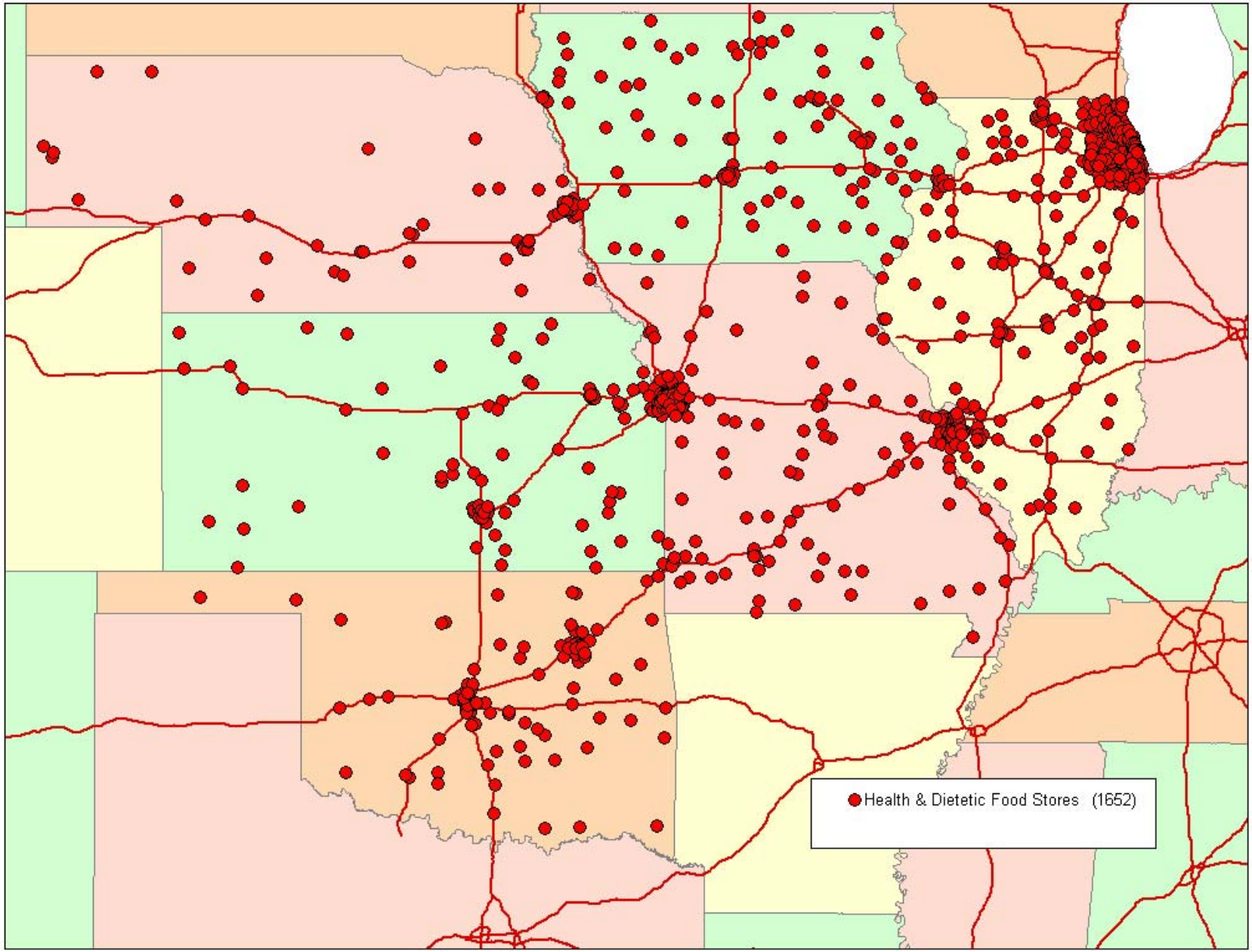
Flour (57)
Flour & Other Grain Mill Products, nec (15)
Flour Mixes (11)


Health & Dietetic Food Stores (1652)

Appendix F

November 25, 2003

FIRM NAME
ADDRESS 1
CITY, STATE ZIP

Dear (FIRM NAME MERGE FIELD):

The Thomas Jefferson Agriculture Institute is a non-profit organization, based in Columbia, Missouri, that promotes sustainable agricultural practices including the production and use of non-traditional grains. We provide free education programs to producers and consumers on specialty or alternative crops. Recently, the Jefferson Institute worked with the Missouri Department of Agriculture to evaluate the use of amaranth flour in bakery products.

We know that your group takes pride in providing factual information to your members and the public and are interested in the most reliable and up-to-date information on gluten-free products and ingredients. Therefore, we would like to provide the enclosed test results that confirm amaranth as a gluten-free product.

The American Institute of Baking (AIB) performed a gluten allergen test to evaluate gluten levels in amaranth flour. AIB is recognized as one of the major centers for grain product research and development in the entire world. The test documented that gluten was ***not detected*** at the 20 parts per million (ppm) level in amaranth flour. The most stringent standard in the world is currently the Canadian standard at 20 ppm, therefore it is appropriate to conclude that amaranth is safe to be consumed by celiac disease patients in a gluten-free diet. We urge your group to review the AIB test results and consider a formal position supporting amaranth as a gluten-free alternative for celiac patients.

Please feel free to contact me at the Jefferson Institute if you have any questions regarding the enclosed information. I may be reached by phone at (573) 449-3518 or by email at aweber@jeffersoninstitute.org.

Sincerely,

Alan Weber
Thomas Jefferson Agricultural Institute

Enclosure

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