Promoting Hard White Winter Wheat as an Ingredient to Nebraska Food Manufacturers

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The Food Processing Center

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The University of Nebraska-Lincoln (UNL) Food Processing Center is a partner of the Nebraska Manufacturing Extension Partnership (NEMEP) program. The Nebraska MEP is a statewide program established in 1994 to help and assist Nebraska manufacturers build on their strengths, identify and capitalize on opportunities, and increase competitiveness and profitability. Its principal objective is to help manufacturers, especially the small manufacturers, adopt new technologies, processes and business practices so that American manufacturing can be more productive and competitive. The National MEP network consists of over 2,000 professionals, working out of more than 400 centers in all 50 states, providing direct advice and assistance to manufacturers.

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Introduction

The U.S. Wheat Industry has been seeking to have a hard white winter wheat development program included in the 2007 farm bill. Objectives of the program include the following:

1. Establishing hard white winter wheat as a viable U.S. market class
2. Increasing hard white winter wheat acceptance in U.S. domestic and export markets
3. Creating a sustainable, critical mass that would supply the market with a year round supply
4. Accomplish the above by 2011

A supplemental aspect is to provide assistance to wheat breeding programs that will lead to additional new varieties with improved production and end-user characteristics. This will aid in hard white winter wheat production to reach the critical mass stage. Clearly, expansion of the production and use of hard white winter wheat is a priority of the U.S. wheat industry. Its adoption by high profile food manufacturing companies can aid in raising the awareness of the functional and nutritional benefits of hard white winter wheat.

The Food Processing Center (FPC) at the University of Nebraska-Lincoln, through equipment and personnel, is uniquely positioned to both promote and develop hard white winter wheat use in Nebraska. Business professionals at The FPC have extensive contacts and existing relationships within the food manufacturing industry in Nebraska. Product developers at The FPC have an established, successful history of creating or optimizing a wide range of food products.

Background

The first hard white winter wheat lines released by Kansas State University to the American White Wheat Producers Association occurred in the 1980s. The use of Australian white wheat varieties for flat breads in the Middle East and noodles in Asia provided the inspiration to pursue development of hard white winter wheat varieties in the U.S. In 1990, hard white winter wheat was recognized as a separate wheat class by USDA-FGIS. It was predicted that production of wheat would transition to white varieties from the traditional red varieties; however, hard white winter wheat production has not captured anticipated market share. Kansas' production of hard white winter wheat was less than 0.8% of Kansas wheat acres in 2001.

Hard white winter wheat has some systemic disadvantages that must be overcome before hard white winter wheat production will achieve critical mass. These include the need for it to be segregated at the elevator and the mill, a current lack of demand, existence of a slight yield drag and incidence of pre-harvest sprout. Still, hard white winter wheat is

being touted as having some advantages over hard red winter wheat. The white bran permits a higher milling extraction level, the 'white' bran color does not show up as colored specs in the finished food product and products made with whole white wheat are close in color to products made with regular white wheat flour. Additional potential health related benefits include increased fiber and the presence of antioxidants. Once critical mass is achieved, hard white winter wheat may also have enhanced export potential in the Asian and Middle Eastern markets.

The eventual goal is to promote and facilitate the adoption of Nebraska hard white winter wheat into existing food products manufactured in Nebraska to demonstrate its efficacy. As such, this project has the following objectives:

1. Identify 2-3 Nebraska food manufacturers as potential users of hard white winter wheat
2. Promote the use of hard white winter wheat to targeted manufacturers' for use in their products
3. Facilitate the trial and/or adoption of hard white winter wheat through a combination of market research and product adjustment
4. Promote the use of hard white winter wheat to end-users of the food manufacturers' products

About The Food Processing Center

The Food Processing Center at the University of Nebraska in Lincoln, Nebraska has been providing confidential and proprietary market development, business development, and technical food science assistance to the food processing industry since 1983, both within the State of Nebraska and nationwide. A full-time staff of non-academic managerial professionals and food scientists carries out projects. Proximity to the Departments of Food Science and Technology, Agriculture Economics, Meat Science, Agronomy, Plant Sciences, etc. gives staff ready access, as needed, to faculty expertise in a variety of disciplines.

Dr. Rolando Flores serves as the Director of The Food Processing Center.

Methodology

As a starting point for the project, a literature review of white wheat product development was conducted for background purposes to avoid duplication of past efforts and to learn from those previous efforts. The results of the literature review were used internally and are not presented here.

The Food Processing Center utilized its network within the food manufacturing industry to identify a pool of candidates that were evaluated and ranked according to the following criteria:

1. Likelihood to participate in a white wheat product development and promotion pilot project
2. Visibility within the food industry and in Nebraska
3. Suitability of the company's product line for incorporating white wheat

Once the target list was identified, The Food Processing Center contacted targeted companies seeking to secure their participation in the pilot project. The original workplan sought the use and promotion of hard white winter wheat by the food manufacturer(s) to have a targeted duration of four months; however, in order to achieve a more sustainable impact, efforts were focused on identifying opportunities that had the highest potential to become permanent product line extensions for the participating company(s). For each participating manufacturer, 1-2 product categories were identified for potential product development. Adjustments to the product formulation(s) were conducted by The Food Processing Center to optimize the sensory and functional characteristics of the reformulated product(s).

Prior to and during product reformulation/adjustment, The Food Processing Center worked with the participating food manufacturer(s) to identify potential end-user markets for the developed product(s). The Nebraska Wheat Board can use these 'case studies' to promote the use of hard white winter wheat.

The following outlines the original workplan for the project:

1. Identify food manufacturing candidates for the pilot project
    a. Research and evaluate potential candidates using specified criteria
    b. Rank order food manufacturers according to suitability

2. Contact targeted food manufacturers to secure participation in the pilot project
    a. Prepare project presentation for use during company visits
    b. Negotiate and sign confidentiality agreements with participating companies
    c. Negotiate the roles and responsibilities of each participant in the pilot project

3. Reformulate and/or adjust identified products with hard white winter wheat as primary grain
    a. Make adjustments to product formulation as needed to optimize sensory and functional attributes
    b. Conduct nutritional analysis and prepare new product labels, if required
4. Develop and implement a promotion plan for end-users
    a. Work with participating food manufacturers to create a promotion plan targeted to end-users on the benefits of hard white winter wheat-based products

Project Results

Company Recruitment

The fundamental goal of this project is the expansion of white wheat acres in Nebraska through the development of products using white wheat as the featured ingredient. In order to accomplish this goal The Food Processing Center sought the participation of food manufacturers and/or foodservice establishments whose product line was appropriate for incorporating white wheat. These included various bakeries, restaurants, bread manufacturers, breweries, and wineries. The complete list of potential candidates, with location and product line for each, is listed in the table below.

Candidate Companies for White Wheat Product Development

Company	Location	Products
Beatrice Bakery Company	Beatrice	Variety of fruitcakes
Beaver Bakery	Beaver Crossing	Baked goods, croissants
Brownville Mills	Brownville	Custom ground Flours & Grains: blue corn, amaranth, wheat, & corn. Nemaha Valley brand grains and cereals.
Capo Di Tutto Pasta	Lincoln	Pasta
Casa De Oro Foods	Omaha	Wheat flour tortillas
Empyrean Brewing Co.	Lincoln	Draft and bottled small-batch specialty ales and lagers
Golden Waves Of Grain Bakery	Omaha	Whole grain bread, pizza crust.
Grain Place Foods, Inc	Marquette	Organic grains, cereals, popcorn & dry edible beans
Le Quartier Baking Company	Lincoln	Bread, various pastries and baked items
Midwest Bread Inc/The Grain Bin Bread Co.	Lincoln	Bread bakery
Mio Amore Pasta	Edgar	Organic Pasta
Old Market Sourdough	Omaha	Breads including baguettes, multigrain rounds, pain au lavon (French bread), and seeded batard
Orsi's Italian Bakery	Omaha	Italian breads, hard rolls & dinner rolls
Rotella's Italian Bakery	LaVista	Bread & rolls; 240 varieties of breads, rolls and other baked goods

Sara Lee Bakery Group-Bellevue	Bellevue	Baked goods: breads & buns; shelf-stable pizza crust
Sara Lee Bakery Group-Hastings	Hastings	Baked goods: bread, buns & dinner rolls
Sara Lee Bakery Group-S Sioux	South Sioux City	Baked goods: buns, fried fruit pies & croutons
Sehnert's Bakery & Bieroc Café	McCook	Variety of breads, doughnuts, muffins. Wiemers Pizza Crusts
Super Bakes Inc.	Lincoln	Frozen foods for fundraising: breads, cinnamon rolls, cookie dough, pizza, Mexican food, cheesecakes, lasagna, pies, pretzels, bagels, pasta
Tabora Farms Bakery, Inc.	Cozad	Frozen dough products: bread, bun, cookies, cakes, pies, and pastry products
The New Wahoo Bakery Llc	Wahoo	Assorted bakery items
Wauneta Roller Mills	Wauneta	Wheat flour & livestock seed formula (incl. ostrich)
Red Moon Bakery	Lincoln	Various bakery products - muffins, rolls, cupcakes, specialty cakes, scones, etc. Retail storefront plus wholesale accounts
Schilling Bridge Winery & Microbrewery	Pawnee City	Wine and beer
Spilker Ales	Cortland	Eight types of beer and a root beer as well. Has a "Cortland Wheat," which is light colored and mild flavored
Aksarben Brewing Co	Omaha	

Food Processing Center staff reviewed the company list to prioritize on-site visits to present the project objectives and obtain their participation in the project. The initial visit list included the following five companies. Due to The Food Processing Center's strict policy regarding confidentiality of client information, only brief summary of non-confidential information is provided in the summaries below:

Schiling Bridge Winery and Mircrobrewery

Schilling Bridge Winery and Microbrewry was identified as a candidate due to their microbrewry operations and a track record of innovation in both its winery and microbrewry operations. Dr. Dave Rickert and Mark Hutchison visted Schillingbridge and met with the owners, Mike and Sharon Schilling and their winemaker, Max Hoffman. The Schillings were interested in the concept of a wheat beer but did not have the time or capacity to develop and trial a new beer at this time. The Food Processing Center does not have microbrewry equipment to conduct in-house product development. The Schillings did not rule out evaluating a white wheat beer in the future.

The New Wahoo Bakery

The New Wahoo Bakery is a small hometown bakery in Wahoo, Nebraska that produces a variety of bread and other bakery products. These products are sold through its own retail counter as well as distributed to other retail businesses in the surrounding area. Due to limited labor capacity and volume potential further discussions were not pursued with this company.

Tabora Farms Bakery, Inc.

Tabora Farms Bakery produces a wide variety of par-baked bakery items for the retail and foodservice market on a national basis. Rickert and Hutchison visited the bakery and made a project presenation to the Owner, Sales Manager and Production Manager. All were very interested in trialing a variety of white wheat products—both new and line extensions to their current offerings. Dining services at the University of Nebraska-Lincoln was willing to trial the new products developed as a result of the project; however, during preliminary product development discussions, it was determined that a combination of ingredient sourcing and processing issues were too significant to overcome and the project was set aside. At about this same time another company expressed strong interest in the project so further discussions were delayed.

Spilker Ales

Although this microbrewery is known for its wheat beer, The Food Processing Center was not able to secure an appointment with this company to present the project.

Beatrice Bakery Company

Initial discussions regarding the project were held with the President of the company, Rick Curlett. Curlett has interest in developing new products; however, other company priorities and product development efforts superseded moving forward with a white wheat product development project. As this company evolves, additional opportunities may arise for the development or incorporation of white wheat into the company's product line.

Casa De Oro

An appointment was secured with this company; however, the visit was cancelled due to scheduling conflicts and the emergence of Sehnert's Bakery as a viable and enthusiastic partner on the project.

Empyrean Brewing Company

This company was contacted for an appointment but was not interested in scheduling an on-site visit.

Midwest Bread, DBA The Grain Bin Bread Company

Ultimately, this company was not contacted regarding this project. The Center conducted initial product development with various bread formulations and drafted a preliminary merchandising and marketing plan for a white wheat bread trial in their retail store. Center staff continue to believe this company or one similar is an excellent candidate to not only offer a white wheat product in their product line but also promote white wheat to the end user (i.e.—consumers).

Sehnert's Bakery

The Center made an on-site visit to Sehnert's Bakery in McCook, NE. Sehnert's produces par-baked pizza crusts for the retail and foodservice markets that are distributed in multiple states by Cash Wa Distribution. In Sehnert's decision making process regarding project participation, the company sought input from various sources on the market for a white wheat pizza crust. The following quotes come from those interactions:

> *"Whole White Wheat is a growing segment in the schools…I am not sure of any products on the market that are prepared with it as of yet."*

> *"Great idea especially if you can get out with it first. We don't stock any products like this, but I know that I could sell it."*

Sehnert's is interested in developing a pizza crust with additional nutrition and agreed to participate in the project. Sehnert's worked closely with The Center in the development of multiple prototypes of par-baked pizza crusts. Sehnert's entered the project with the expectation of adding the product to their product line if it met their specifications and performed well in market tests. The results of the development process and the market test are presented in the following section.

Product Development

White Wheat Variety Selection

Sourcing white wheat for use in product development activities was a more daunting task than originally expected. The Center worked with various contacts within the wheat industry, including the Executive Director of the Nebraska Wheat Board, Nebraska Wheat Board members, brokers, grain buyers, and food processors. Every effort was made to source flour from Nebraska grown white wheat and Nebraska white wheat varieties. In the end Arlin, RonL, and Danby were used in the flours selected for use in the project.

The table on the following page provides a summary of the sources for white wheat flour used during food product development activities:

White Wheat Flours

Company	Flour Name	Flour Analysis		Applications
Farmer's Direct	Genuine Stoneground Whole Wheat Flour	Protein Total Dietary Fiber Fat Moisture Ash Unmalted/No treatment	12.8% to 13.2 % 11% to 13% 1.5% to 2% Maximum 10% 1.4 to 1.8% 300 min.falling#	Baked foods, variety breads, rolls, pizza crusts, tortillas, bagels
	Handcrafters Flour	Protein Moisture Ash Falling Number Absorption	11.4% (+/-.3%) 14% (Max) .55% (+/-.05%) 255 Sec. (+/-15) 63 (+/-2)	Artisan style 'crusty' hearth breads and rolls, flatbreads, and flour tortillas
King Arthur Flour Company	White Whole Wheat Flour	Moisture (Max) Protein Ash Falling Number Treatment Enrichment	<14% 13.0% (+/-1.0%) 1.5% (Min.) 330 Sec. (Min.) None Unenriched	Cookies, bars, bread, muffins, pancakes
Hodgson Mill	White Whole Wheat Flout	n/a	n/a	"substitute for any type of flour"
Stafford County Flour Mills Co.	Hudson Cream Whole Wheat	n/a	n/a	Breads (only noted)
Ultragrain™	White Whole Wheat made with Ultragrain™	Protein Total Diet. Fiber Fat Moisture Ash	13.7% 12.2 % 1.9 % 10.3 % 1.6 %	Pizza crust, bread, cookies, muffins

Sehnert's Bakery Product Development

One of the early discussion points in the project was whether to develop a 100 percent whole wheat product or one that was a blend of whole white wheat with refined wheat flour. From a marketing standpoint, there are significant advantages to developing a 100 percent whole wheat product due to the nutritional advantages such a product provides over products make with refined flour. One of the key advantages of white wheat confirmed during the literature review is a lighter color and a sweeter, less bitter flavor. This decision point is product dependent and influenced by the desired target market. In

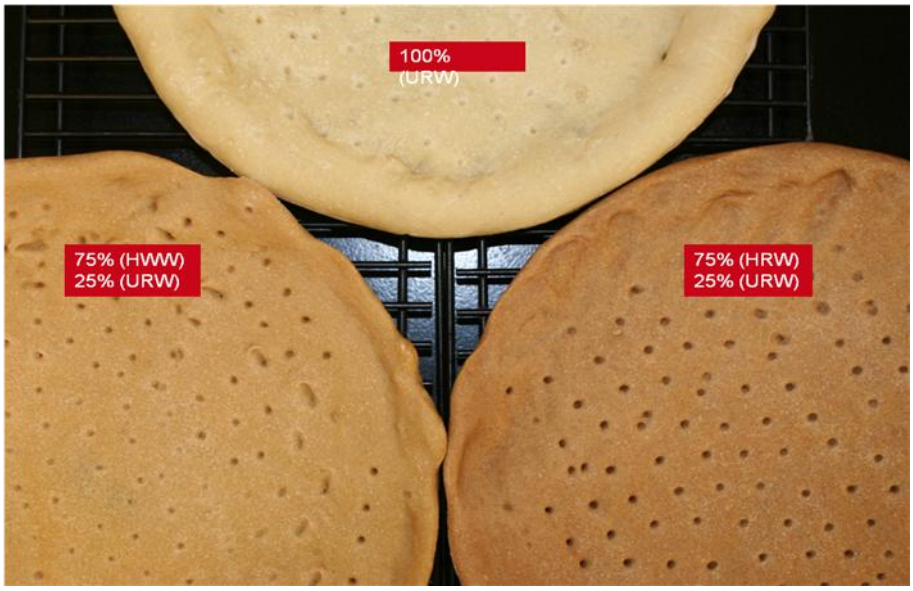
the case of a pizza crust application intended for foodservice, specifically schools, a balance between improved nutrition and acceptable taste is mandatory.

Numerous pizza crusts were made using four of the sourced white wheat flours—Farmers Direct's Genuine Stoneground Whole Wheat Flour and Handcrafters Flour; King Arthur Flour Company's White Whole Wheat Flour; and ConAgra's Ultragrain. Pizza crusts using blends of whole wheat flours and refined white wheat flours were developed by Center staff and Matt Sehnert. NOTE: Product formulations are not included in this report as they are proprietary to Sehnert's Bakery.

The following picture shows three doughs made with varying combinations of dough blends. They are:

1. Far left: 100% Unbleached red wheat flour (control)
2. Center: 75% Hard white wheat, 25% Unbleached red wheat flour
3. Far right: 75% Hard red wheat, 25% Unbleached red wheat flour

The picture on the following page shows three par-baked pizza crusts using the same flour blends described above. The crust with the 75% white wheat and 25% unbleached red wheat flour has a lighter, more favorable color then the one made with 75% hard red wheat flour and 25% unbleached red wheat flour. The comparison here is clear; however, when standing alone the crust made with the white wheat flour retains a slight wheat colored appearance similar to 100 percent whole wheat products. It is this appearance that will present the greatest challenge in marketing. The most successful marketing strategy will seek to compare the product to 100 percent whole wheat products, not to products made with traditional refined white flour made with red wheat.



At the conclusion of the project, Sehenert's Bakery continues to optimize the formulation; however, the company continues to have strong interest in marketing a product using hard white winter wheat as the primary ingredient. The final blend will be impacted by the quantity of whole wheat necessary to achieve a serving of whole grains. The ability to offer a product that offers a serving of whole grain will help schools and other institutions with similar nutritional objectives meet them.

Additional, non-proprietary questions regarding the product development process can be directed to The Food Processing Center.

Promotional Activity

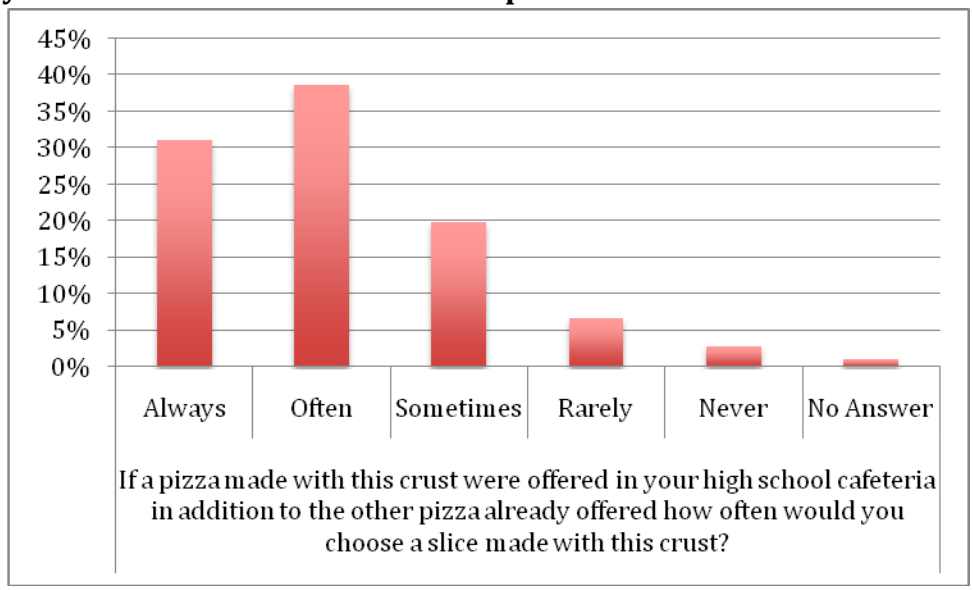
Nebraska Agricultural Youth Institute

To assess Sehnert's Bakery's white wheat pizza crust, participants in the 2009 Nebraska Agricultural Youth Institute (NAYI) were served pizzas made with Sehnert's par-baked white wheat pizza crust. The pizza event was one of the evening meals served during NAYI. The Nebraska Department of Agriculture's website, describes NAYI as follows:

> *NAYI is a four-day conference held in mid-July in Lincoln, Nebraska. It is for high school juniors and seniors. Each year, approximately 140 delegates attend the Institute. Knowledgeable speakers motivate, address current issues and inform the delegates about the future of agriculture. There is also time for group discussions and interaction, as well as a variety of evening activities.*

The attendees were given a short survey when they were served the pizza and asked to honestly evaluate the pizza crust and their intended likelihood to eat it in various situations. The results of the survey are provided below:

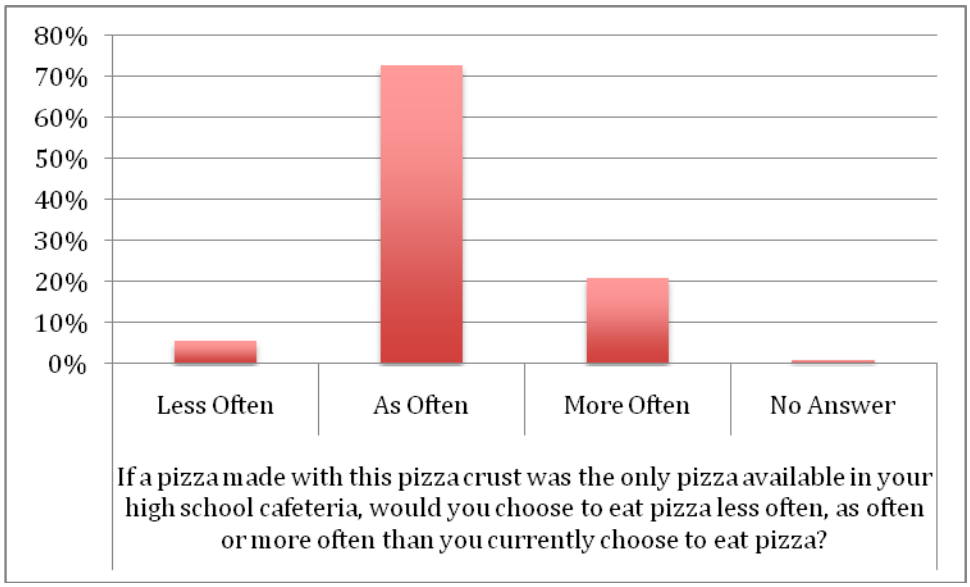
Frequency of selection if offered with other pizzas



Raw Data

	Always	Often	Sometimes	Rarely	Never	No Answer
Number	33	41	21	7	3	1
Percent	31%	39%	20%	7%	3%	1%

Approximately 70 percent of respondents indicated they would select a pizza made with this crust either always or often if offered along with the pizzas already offered in their high school cafeteria. Only 10 percent indicated they would rarely or never choose it.



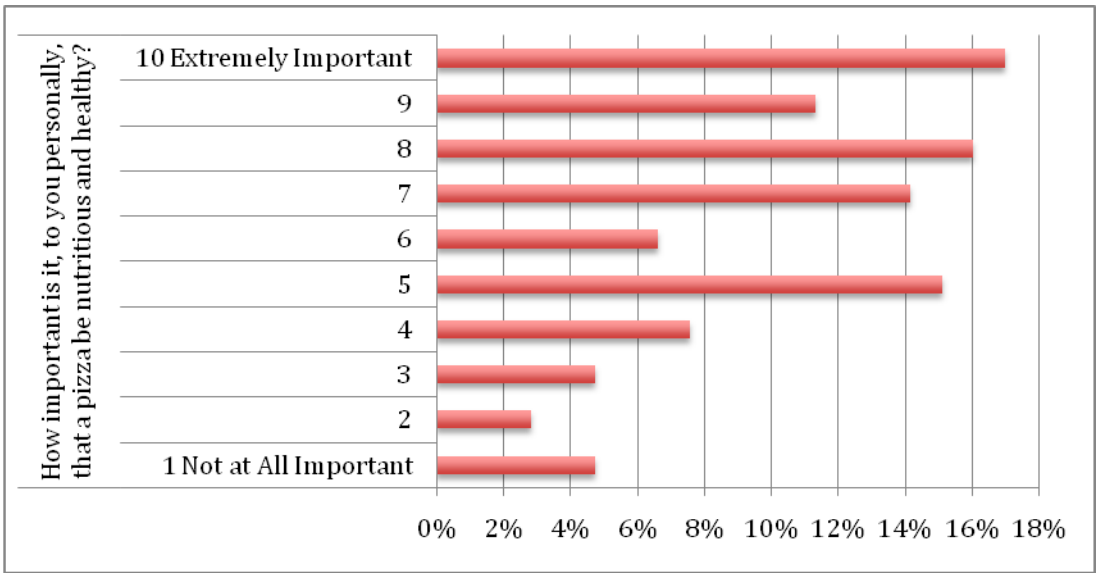
Frequency of Selection if only pizza available

Raw Data

	Less Often	As Often	More Often	No Answer
Number	6	77	22	1
Percent	6%	73%	21%	1%

Approximately 94% of respondents said they would eat pizza as often or more often than they do currently if the only pizza available in their high school cafeteria was made with the white wheat pizza crust. This survey result should be used when marketing the white wheat pizza crust to schools.

Importance of Pizza Being Nutritious and Healthy

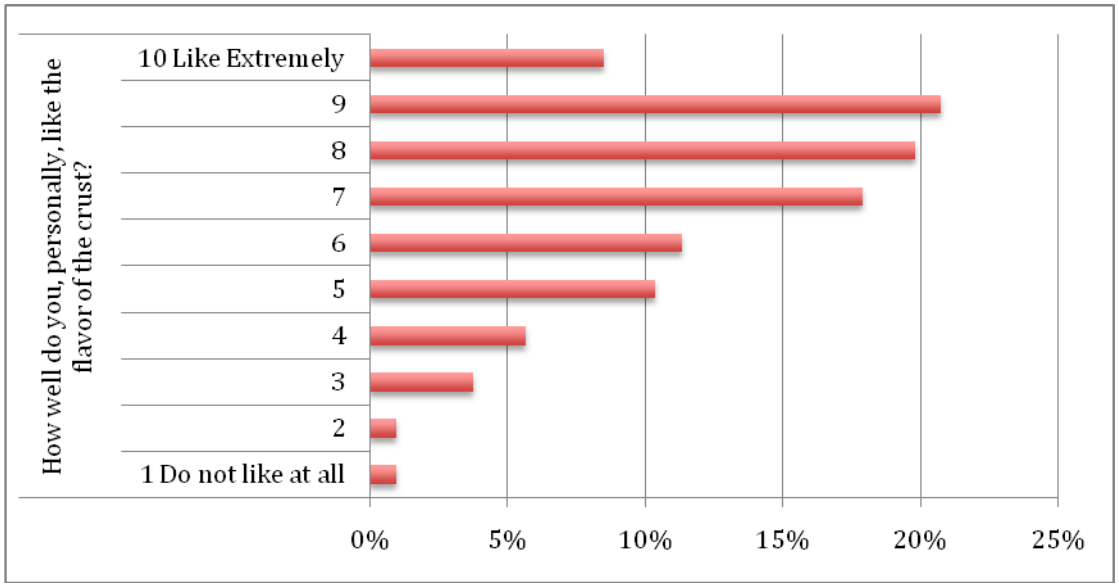


Raw Data

How important is it, to you personally, that a pizza be nutritious and healthy?

	1 Not at All Important	2	3	4	5	6	7	8	9	10 Extremely Important
Number	5	3	5	8	16	7	15	17	12	18
Percent	5%	3%	5%	8%	15%	7%	14%	16%	11%	17%

Approximately 28% indicated that they thought it was extremely important (i.e.—a rating of 9 or above) a pizza be nutritious and healthy. This may be a surprising result given the sample consists of high school students; however, Generations X and Y have shown greater where their food comes from and what is in it.



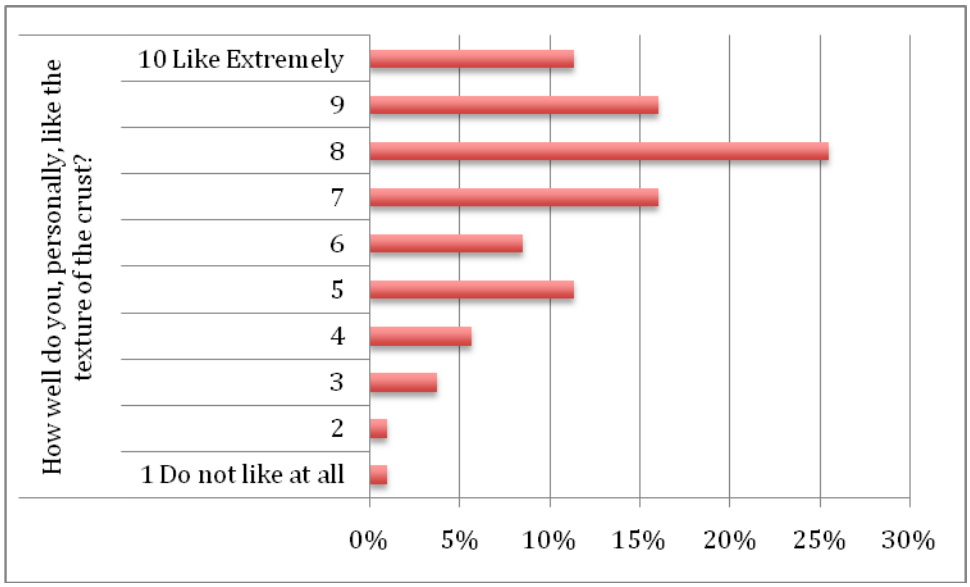
Likeability of the Crust <u>Flavor</u>

Raw Data

How well do you, personally, like the **<u>flavor</u>** of the crust?

	1 Do not like at all	2	3	4	5	6	7	8	9	10 Like Extremely
Number	1	1	4	6	11	12	19	21	22	9
Percent	1%	1%	4%	6%	10%	11%	18%	20%	21%	8%

Only approximately 28 percent of respondents indicated they extremely liked (i.e.—rating of 9 or above) the texture of the pizza crust. Additional analysis and market research is needed to determine if there is a tradeoff between texture likeability and eating a more nutritious pizza. The above responses regarding the respondents willingness to eat pizza with the white wheat crust both as a choice among other pizzas and also as the only pizza offering, when viewed in like of their response to the likeability of the crust's texture, seem to indicate such a tradeoff may exist.

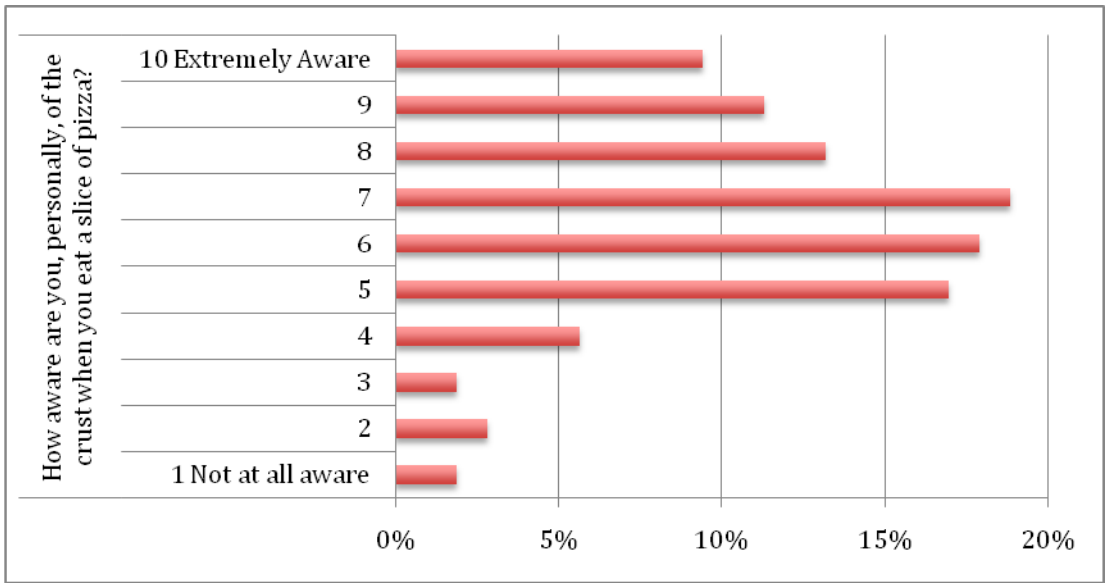


Likeability of the Crust's <u>Texture</u>

Raw Data

How well do you, personally, like the **<u>texture</u>** of the crust?

	1 Do not like at all	2	3	4	5	6	7	8	9	10 Like Extremely
Number	1	1	4	6	12	9	17	27	17	12
Percent	1%	1%	4%	6%	11%	8%	16%	25%	16%	11%



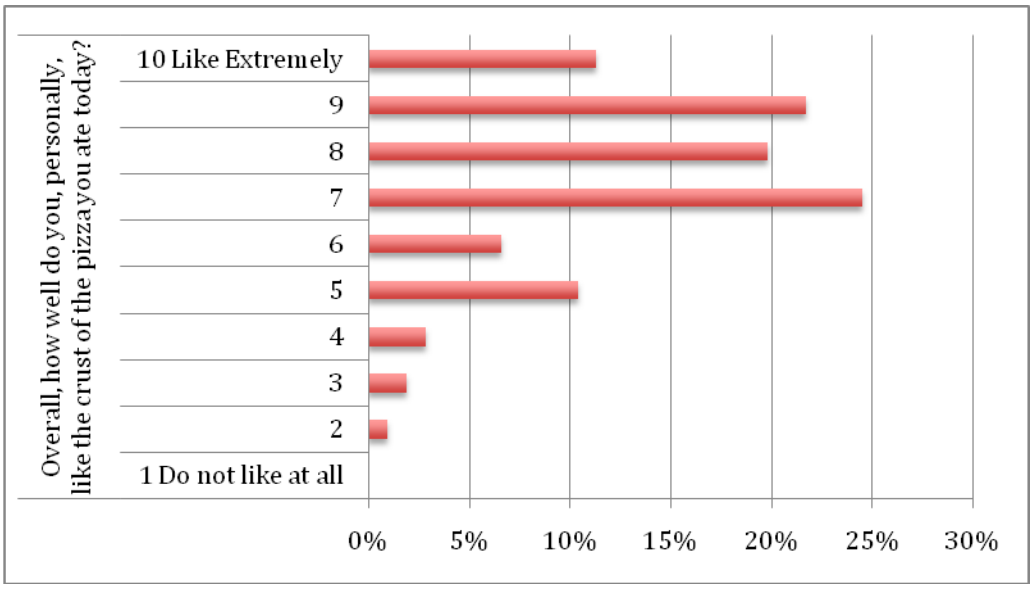
Awareness of Pizza Crust

Raw Data

How **aware** are you, personally, of the crust when you eat a slice of pizza?

	1 Not at all aware	2	3	4	5	6	7	8	9	10 Extremely Aware
Number	2	3	2	6	18	19	20	14	12	10
Percent	2%	3%	2%	6%	17%	18%	19%	13%	11%	9%

There is some variability in the degree to which respondents are aware of the pizza crust when eating a pizza; however, the vast majority, over 70 percent, are at least somewhat aware of the pizza crust when eating a pizza.



Overall Likeability of the Pizza Crust

Raw Data

Overall, how well do you, personally, like the crust of the pizza you ate today?

	1 Do not like at all	2	3	4	5	6	7	8	9	10 Like Extremely
Number	0	1	2	3	11	7	26	21	23	12
Percent	0%	1%	2%	3%	10%	7%	25%	20%	22%	11%

Approximately 78 percent of respondents indicated a positive response to the likeability of the pizza crust. Of this, 33 percent indicated they extremely liked it (i.e.—rating of 9 or above).

Comments from Survey

The following comments are a sample of the comments written on the survey forms:

- It's not as light and crispy of a texture but it tastes healthy and that rocks.
- Rather dry and crisp.
- Bring it into the market.
- It's different.
- Crust could be more puffy.
- Maybe have thinner crust, so that it would be kind of crunchy!
- Love the new crust & how healthy it is!! Also I love the taste!
- It was dry.
- The outside crust is too dense, it needs to be lighter and have a garlic or butter kind of flavor because it tastes wheat-y.
- Grainy, not my favorite texture.
- Very good could hardly tell a difference.
- Good – like the crust and I can't tell a difference.
- Good alternative to pizza especially in cafeterias because kids need better food. Tastes great – but not cooked all the way…Less greasy too! Really tastes amazing and you could hardly decipher the difference.
- It was really good but not the best…

Survey Conclusions

Overall, survey respondents were positive about the pizza crust. There are some inconsistencies in their responses about their willingness to eat it and the overall likeability and the likeability of the pizza crust. The nutritious features of the crust resonated with at least a portion of the respondents.

There are multiple factors that should be considered when reviewing the survey results. These include, but are not limited to, the methods used to cook the pizzas at the event, varying cooking times, the environment in which respondents were asked to complete the survey, and the identify of the survey administrators (Nebraska Wheat Board). While this survey provides excellent initial feedback, to determine the marketability of the pizza crust, additional market research is needed.

Conclusion

The project objective was to establish a working relationship with a food manufacturer or foodservice operation in Nebraska, develop a product using white wheat as the primary ingredient and promote the product as such.

The Center's relationship with Sehnert's Bakery played a key role in securing their participation in the project. The timing of the project and the functional characteristics of hard white winter wheat were also positives in developing a product that met the objectives of both the Nebraska Wheat Board and Sehnert's Bakery.

The lack of a milling facility in Nebraska outside of those owned and operated by ConAgra made the task of using all Nebraska white wheat a challenging undertaking. Nevertheless, the white wheat products selected for use contain Nebraska grown white wheat and can be promoted as such.

The survey results from the promotional activity were generally positive and should reinforce Sehnert's Bakery's inclination toward bringing a white wheat pizza crust to the market.

Near the conclusion of this project, Valentino's expressed some interest in developing an All-Nebraska Pizza that would incorporate white wheat in the crust. This emerging development should bring further attention to the potential of white wheat in product development.

Appendices

Appendix 1

References

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