Development of Pulse Based Gluten-Free Shelf-Stable Ready-To-Eat Meals Using Retort Technology

(Final Report)

Submitted to

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1.0. INTRODUCTION

Canada has developed a multi-billion dollar pulse industry. In 2011, Canada exported a record 4.7 million tonnes of pulses worth nearly $2.7 billion. There are nearly 3,000 producers of peas, edible beans, soybeans, faba beans, chickpeas and lentils, and total pulse acreage in 2011 was approximately 660,450 acres across Manitoba. Pulses are low in fat and rich in dietary fibre containing both soluble and insoluble fibre, complex carbohydrates and protein, and are packed with essential nutrients such as vitamins and minerals.

Pulses are also gluten-free, making them an excellent choice for people with Celiac disease or gluten intolerance. Many health organizations recommend eating pulses which can lower blood cholesterol, help with weight management and blood sugar control. Human clinical trials conducted from 2006 to 2008 revealed that regular pulse consumption had positive health benefits (Pulse Canada a & b, online: accessed on 21 January, 2015). Dry beans are high in antioxidant phenolic compounds, especially seed coats, which will prevent from the formation of harmful free radicals (Boateng et al., 2008). Eating Well with Canada's Food Guide suggests that regularly consuming beans and other meat alternatives can help minimize the amount of saturated fat in the diet. A recent study indicates that the phytic content (approximately 5% in legumes on a dry weight basis), which is also known as an anti-nutrient content of dry beans may have the ability to prevent certain type of cancers, heart disease, and diabetes (Boateng et al., 2008; Hall, C. online: accessed on 20 January 2015; Shi et al., 2004). In addition to their nutritional profile and links to improved health, pulses are unique foods in their ability to reduce the environmental footprint of our grocery carts.

Ready-to-eat food/meals offer combined benefits of great taste, convenience, health, variety, and food safety. Consumer studies around the world have confirmed that the biggest reason for purchasing ready-to-eat meals is convenience. Over 80% of the consumers agree that ready-to-eat meals come in handy for consumers with busy lifestyles. Ready-to-eat meals are also considered a field ration, and an essential supply in case of emergency situations. The most widely used method for preserving food and extending shelf life is the thermal processing. Thermal processing normally refers to in-package/container sterilization of food. Typically, the method of in-container sterilization, hermetically sealed, is performed in a retort system in batches or in a continuous method. The retort system is a pressurized cylindrical vessel which is either horizontal or vertical (Berk, 2009).

Retorting or canning has been the technology of choice for commercial sterilization of shelf-stable low-acid foods which can be stored for months or years without any addition of preservatives. Most of the commercially available low-acid, shelf-stable products in the market are retort processed (Jeremy and Balasubramaniam, 2009).

Currently, the canning industries use different packaging materials such as metal cans, glass jars, plastic containers, easy open ends and pouches for retort processing. The retort pouch is a flexible laminated food package that can withstand thermal processing up to 130°C (Awuah et al., 2007). It has the advantage of offering shelf stability of metal cans, coupled with preservation of texture and nutrient value associated with frozen foods. The retort pouch has been considered the most significant advancement in food packaging since the metal can (Canadian Food Inspection Agency, 2002). Comparatively, the rate of heat transfer is high in retort pouches than with a similar volume of metal and glass containers (Awuah et al., 2007). Recently the food industry has seen retort pouches and trays/cups gaining popularity in the market place.

Lack of processed products, lengthy cooking time, and adverse role of antinutritional factors are still some of the main reasons for low consumption of pulses and soy beans in North America. Boateng et al.(2008) reported that the daily per capita consumption of all bean products in the United States is only 9g, whereas in Asia it is 110g which is 12 times higher. Hence one of the current research priorities for the growers and processing industry sector is to develop value-added pulse based food products that can meet the consumers' demand for higher consumption. Although many different canned pulses are readily available in the market, they mostly come with sample formulation and are only considered and used by consumers as a cooking ingredient or side dish.

The objective of this project is to develop an innovative, gluten-free, shelf-stable and ready-to-eat meal with a variety of pulses that will deliver a balanced nutritional value, great taste profile, multiple health benefits and convenience to the consumer. Therefore, ten pulse-based gluten-free, shelf-stable, ready-to-eat meal prototype products were developed through this project. They all have acceptable sensory profiles, containing a mixture of edible beans, soybeans, and wild rice along with other natural food ingredients. The products were packaged in retort pouches and fully cooked to achieve the commercially sterile standard. It can be served as a full vegan meal or as a part of a meal selection. It will have a long shelf life, greater than twelve months at room temperature.

This technical report summarises the prototype formulations, retort process recipes, product testing and sensory evaluation results, and nutritional labels. The technical information will allow for further scale up to commercial production. The results suggest that there are great potentials in the market place if these new products can be commercialized, which will benefit the growers, processors and consumers, and will have a significant economic impact in the market place.

2.0. MATERIALS AND METHODS

2.1 Materials:

The materials used in the preliminary and prototype development trials, which include packaging material, pulses and seasoning ingredients are given Table 1.

Table 1. List of package material and ingredients

Material	Supplier	Additional Information (specifications, variety, crop year)
Gold Retort Pouch	Flair Flexible Packaging Corporation	pre-formed, 4oz. w/1-color black warning print, vl145mmx200mm, PET/PRN/DL/AL-FOIL/ONY/DL/CPP-R
Wild Rice	Shoal Lake Wild Rice Ltd.	2012 crop year
Quinoa		
Soybean	Local Manitoba growers	OAC Erin, Non-GMO, 2012 crop year
Black Bean		Eclipse, 2012 crop year
Pinto Bean		Windbreader, 2012 crop year
Navy Bean		Cargo, 2012 crop year
Red Bean		2012 crop year
Red Kidney Bean		Pink Panter, 2012 crop year
Chickpeas	Three Farmers	
Suprasel Loso OneGrain A30	AkzoNobel (distributor: Dealers Ingredients)	n/a
Tomato Juice, 100% Canada Fancy	Safeway Ltd.	n/a
Black pepper powder		
Garlic powder		
Onion powder	McCormick Canada	n/a
Cream Buds – Asia	Butter Buds Food Ingredients (distributor: Dealers Ingredients)	n/a
Salt	Sifto Canada Corp.	n/a
Molasses	Crosby Molasses Co. Ltd.	n/a

2.2 Equipment

2.2.1 Retort: APR-95 Rotary Pilot Retort, with FDA accepted control system that can simulate commercial process, Stock America Inc.

2.2.2 Heat Sealer: 24OB-14001-SSH-CRF-T1_KY, Therm-O-Seal,

2.2.3 Data Acquisition System: Rotary CALPlex 32 Channel Datalogger, with CALSoft 5.0.5., TechniCAL Inc.

2.2.4 Scale, Sartorius, CP 4202 S, Sartorius AG Göttingen

2.3 Analyses

2.3.1 pH: measured with Accumet XL50 pH meter at room temperature (15 - 20 °C)

2.3.2 Moisture content: measured with Denver Instrument IR-30 rapid moisture analyzer at 130°C

2.3.3 Microbiological analyses:

MFHPB-33 – Enumeration of Total Aerobic Bacteria in Food Products and Food Ingredients Using 3MTM PetrifilmTM Aerobic Count Plates

MFHPB-34 – Enumeration of E.coli/Coliform Count in Food Products and Food Ingredients Using 3MTM PetrifilmTM E-coli/Coliform Count Plates

MFHPB-32 – Enumeration of Yeast and Mold in Food Products and Food Ingredients Using 3MTM PetrifilmTM Yeast and Mold Count Plates

2.4 Formulation

2.4.1 Ingredient sourcing and assessment

Edible beans, peas, chickpeas, soybeans and wild rice were identified and sourced from local growers. Other ingredients were identified and purchased from ingredients suppliers and food store.

2.4.2 Product formulation development

The processing properties and nutritional value of different pulses were reviewed and tested. An internal expert panel were formed for preliminary sensory and acceptance testing. On that basis, the ratio of different major and minor ingredients were determined and optimized.

2.4.3 Thermal process validation

Temperature Distribution (TD) Test and Heat Penetration (HP) Test were carried out according to the protocols by Institute for Thermal Processing Specialists (IFTPS):

- Protocol for conducting temperature distribution studies in water-cascade and water spray retorts operated in a still mode, including agitation systems in the still mode
- Protocol for carrying out heat penetration studies

2.5 Packaging examination

Pouches were checked by visual examination only. Burst test and tensile test were not performed due to lack of specialised instruments.

2.6 Sensory evaluation

Panelists who consumed beans greater than one time per month were selected to participate in the consumer acceptance sensory evaluation. Sensory ballots were developed to evaluate likeness of the prototype product samples by sensory attributes (colour combination, bean flavour combination, overall flavour, tenderness/firmness, overall likeness). Likeness of the product was determined by using a 7-point hedonic scale. Panelists were also asked if they would purchase the product.

2.7 Nutritional facts tables

The Nutritional Facts Tables were created using ESHA Research Genesis R&D SQL Food Analysis and Labelling Software. The program uses a nutrition database with over 55, 000 food items from sources such as USDA Standard Reference database. All ingredients except for cream butter buds were sourced from the Genesis database. Formulations of the blends were entered into the database which combines their nutrient profiles and generates a label based on standard reference and serving size amounts.

3.0. RESULTS AND DISCUSSIONS

3.1 Ingredient assessment and selection

A variety of edible beans, soybean, chickpea, Quinoa and wild rice were sourced from local growers or suppliers. Non-GMO soybean, black bean, navy bean, pinto bean, red bean and wild rice were determined as suitable material for RTE meal formulations based on their properties and availability.

3.1.1 Soaking test and water uptake of the beans and grains

30g of edible beans, chickpeas, soybeans, Quinoa and wild rice were put in 90 ml of cold water and soaked for 24hrs, as illustrated in Figure 1. Water pickup ratio for different grains was calculated based on initial weight and the final weight after soaking and draining as shown in Table 2. The result showed that black bean, pinto bean, navy bean has similar water pickup ratio, and soybean and wild rice have similar water pickup ratio. This information is important for the formulation development in determining the suitable bean blend and water to grain ratio.

Table 2. Water pickup ratio of different grains after soaking

Bean Type	Initial weight (g)	Weight after soaking (g)	Water uptake (%)
Red bean	30	55	183
Kidney bean	30	69	230
Black bean	30	65	217
Pinto bean	30	62	207
Navy bean	30	61	203
Soy bean	30	72	240
Wild rice	30	68	227
Quinoa	30	65	217
Chickpea	30	59	197

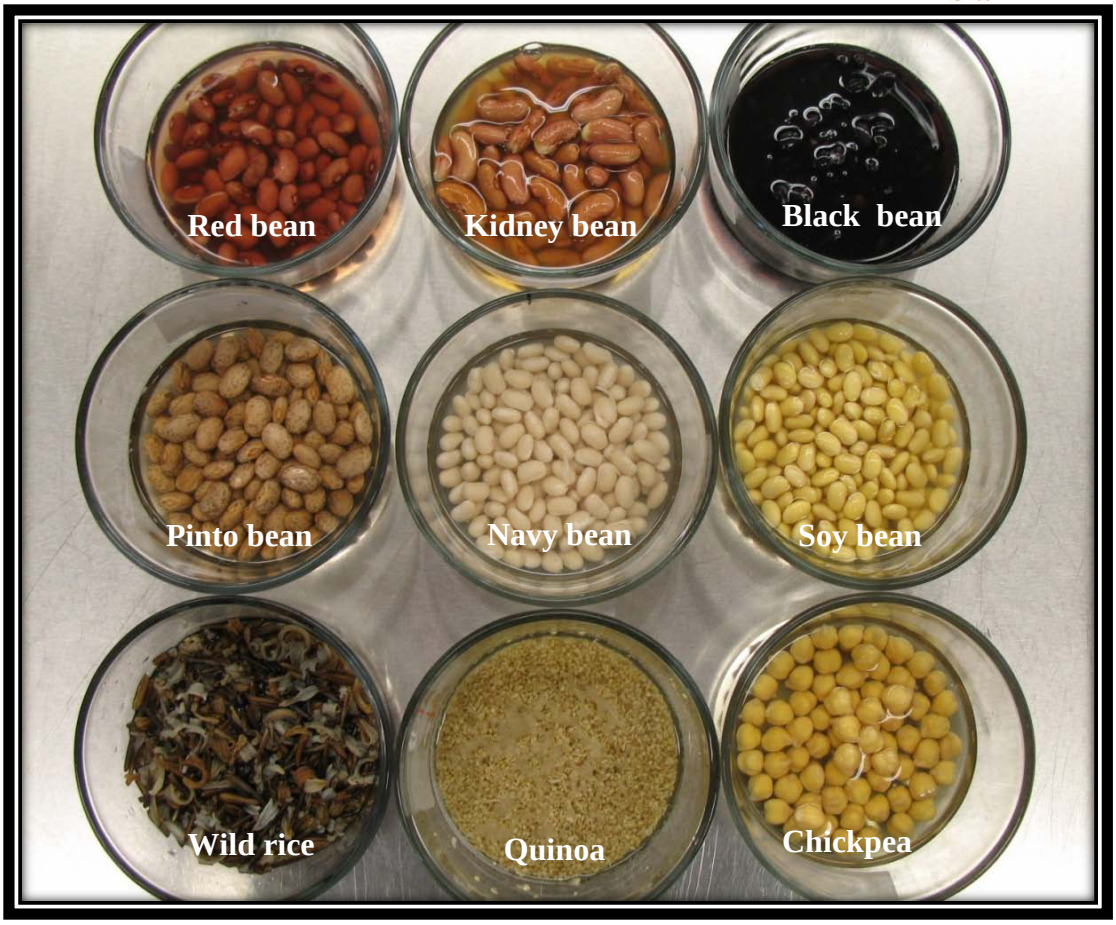


Figure 1. Beans and grains water pick up after 24hr soak

3.1.2 Preliminary thermal process trial with different ingredients

Individual beans and grains that were pre-selected for product formulations were packaged in retort pouches and tested with retort processing, for 20 mins of cook time at 121°C. As illustrated in Figure 2, the result showed that after retorting, kidney beans became slightly mushy and larger in size when compared to others, Quinoa became sticky and gluey, and chickpeas appeared to be undercooked. Therefore these three ingredients were eliminated from further product formulation, while the other six ingredients presented a similar behavior or consistency in terms of their appearance and texture after retorting. Hence, soybean, black bean, pinto bean, navy bean, red bean and wild rice were picked as major ingredients for product formulation.

Table 3 summarizes the preliminary microbiological test results of retorted beans and grains, conducted by FDC's internal Laboratory. Note this result does not suggest that the products tested are sterile, although no microorganisms were detected.

Red bean | Kidney bean | Black bean

Pinto bean | Navy bean | Soy bean

Wild rice | Quinoa | Chickpea

Figure 2. Appearance of beans and grains before and after retorting

Table 3. Preliminary microbiological test of retorted beans and grains

Sample Type	SPC	Yeast	Mould	Coliforms	E. coli
Wild Rice (Retort 8-27-2014)	<10	<10	<10	<10	<10
Red Bean (Retort 8-27-2014)	<10	<10	<10	<10	<10
Pinto Bean (Retort 8-27-2014)	<10	<10	<10	<10	<10
Navy Bean (Retort 8-27-2014)	<10	<10	<10	<10	<10
Kidney Bean (Retort 8-27-2014)	<10	<10	<10	<10	<10
Chick Pea (Retort 8-27-2014)	5*	<10	<10	<10	<10
Soy Bean (Retort 8-27-2014)	<10	<10	<10	<10	<10
Quinoa (Retort 8-27-2014)	<10	<10	<10	<10	<10
Black Bean (Retort 8-27-2014)	<10	<10	<10	<10	<10

*A single bacteria was found on one of the duplicates for the chickpea – this is 99.99% likely contamination during testing.

3.2 Process development

3.2.1 Blending: All cleaned edible beans and soybeans were sorted and pre-blended according to the ratio in formulations.

3.2.2 Washing: Bean blends and wild rice were separately rinsed with cold water for three times to remove any potential invisible debris, and drained immediately. Soaking was eliminated to simplify the process, improve the efficiency, and also avoid bean breakdowns during processing.

3.2.3 Mixing/formulating: Dry seasonings were mixed well with the washed bean blends.

3.2.4 Filling/Sealing: Bean blends with or without seasonings, wild rice and water (or 100% tomato juice with molasses) were filled in pouches separately according to the formulations. Care was taken to remove any excess air from the pouches manually prior to sealing as it may affect the heating efficiency. The pouches were sealed carefully with a heat sealer and were visually checked for any leaking as it was an important step prior to thermal processing. The sealed pouches were shaked gently to allow the ingredients to spread evenly within the pouch for uniform blending.

3.2.5 Retorting / Thermal processing: The product pouches were placed in a retort immediately after filling and sealing, and then processed using high temperature and pressure. Steam/Water Spray MODE was the choice for retort processing of the product packaged in retort pouches.

3.2.6 Labeling: The retorted pouches were paper towel dried, cleaned and labeled.

3.2.7 Process flow chart: Figure 3 summarizes the overall process flow for the production of pulse based gluten-free shelf-stable ready-to-eat meals.

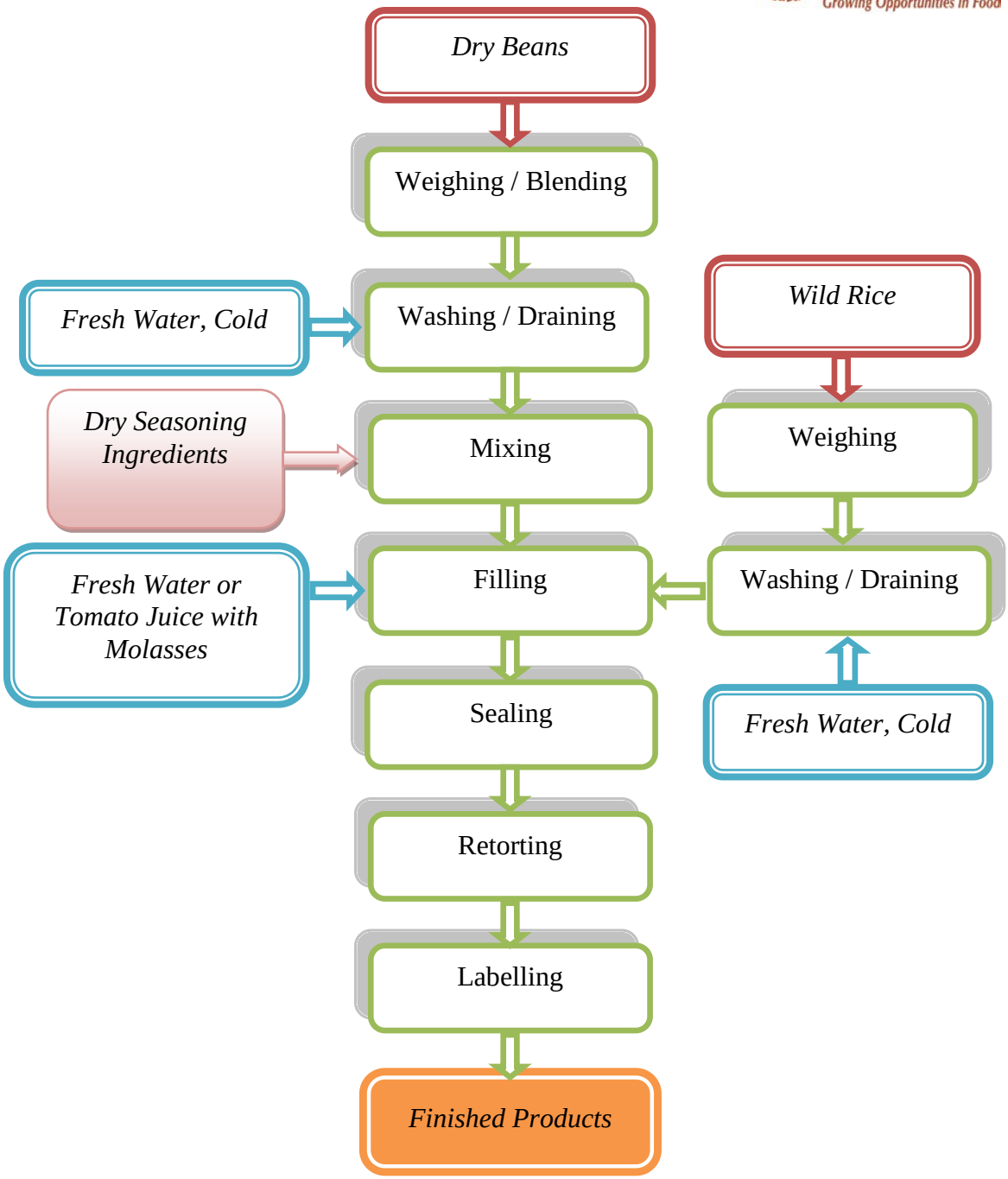


Figure 3. Process flow of retort RTE meals

3.3 Formulation of the prototype products

The RTE prototype development work was carried out in two phases, which include Group A (Phase -1) and Group B (Phase-2). Water was used as a cooking medium in Group A prototype development. In addition with that tomato juice was also used as a

cooking medium in Group B. Totally, ten prototype products were developed using Group A and Group B formulations as presented in Tables from 4 to 7

3.3.1 Prototype products of Group A

Based on the preliminary test results, four prototype products as Group A were formulated featuring soybean and black bean non-seasoned and seasoned respectively. The product formulations are summarized in Table 4 and Table 5. Figure 4 illustrates the retorted product in retort pouches, and Figure 5 illustrates the appearance of four prototype products.

The addition of wild rice gave all the products a unique texture and sensory profile as well as an appealing perspective for marketing.

Table 4. Formulations of soybean blend prototype products – Group A

Ingredient	Soybean Blend Plain - A		Soybean Blend Seasoned - A	
	Weight (g)	%	Weight (g)	%
Wild rice	15	6.82	15	6.76
Navy bean (cargo)	20	9.09	20	9.01
Soy bean	20	9.09	20	9.01
Black bean	0	0.00	0	0.00
Red bean	20	9.09	20	9.01
Garlic powder	0	0.00	0.5	0.23
Onion powder	0	0.00	0.5	0.23
Black pepper powder	0	0.00	0.4	0.18
Salt	0	0.00	0.5	0.23
Water	145	65.91	145	65.34
Total (per pouch)	220	100.00	221.9	100.00

Table 5. Formulations of black bean blend prototype products – Group A

Ingredient	Black Bean Blend Plain - A		Black Bean Blend Seasoned - A	
	Weight (g)	%	Weight (g)	%
Wild rice	15	6.82	15	6.76
Navy bean (cargo)	20	9.09	20	9.01
Soy bean	0	0.00	0	0.00
Black bean	20	9.09	20	9.01
Pinto bean	20	9.09	20	9.01
Garlic powder	0	0.00	0.5	0.23
Onion powder	0	0.00	0.5	0.23
Black pepper powder	0	0.00	0.4	0.18
Salt	0	0.00	0.5	0.23
Water	145	65.91	145	65.34
Total (per pouch)	220	100.00	221.9	100.00

Figure 4. The package of prototype products – Group A

Figure 5. The appearance of prototype products – Group A

3.3.2 Prototype products of Group B

Based on the feedback on Group A samples from both expert and consumer panels, six more modified formulations were developed as Group B. The product formulations are summarized in Table 6 and Table 7. Figure 6 illustrates the retorted product in retort pouches, and Figure 7 illustrates the appearance of four prototype products.

100% tomato juice, new seasonings (Cream Buds –Asia and molasses) and a natural innovative salt replacer, OneGrain A30 were used in new formulations.

The wild rice content was also reduced from 6.82% to 4.77% for cost reduction while maintaining the texture profile.

The red bean was eliminated in Group B formulations due to low production in Manitoba.

Table 6. Formulations of soy bean blend prototype products – Group B

Ingredient	Soybean Blend Plain - B		Soybean Blend with Tomato Juice - B		Soybean Blend Seasoned - B	
	weight (g)	%	weight (g)	%	weight (g)	%
Wild rice	10	4.77	10	4.61	10	4.72
Navy bean (cargo)	20	9.52	20	9.22	20	9.43
Pinto bean	20	9.52	20	9.22	20	9.43
Soy bean	20	9.52	20	9.22	20	9.43
Garlic powder	0	0	0	0	0.25	0.12
Onion powder	0	0	0	0	0.25	0.12
Black pepper powder	0	0	0	0	0.25	0.12
Cream Buds - Asia	0	0	0	0	0.6	0.28
OneGrain A30	0	0	0	0	0.5	0.24
Molasses	0	0	2	0.91	0	0
Water	140	66.67	0	0	140.15	66.11
100% Tomato juice	0	0	145	66.82	0	0
Total (per pouch)	210	100	217	100	212	100

Table 7. Formulations of black bean blend prototype products – Group B

Ingredient	Black Bean Blend Plain - B		Black Bean Blend with Tomato Juice - B		Black Bean Blend Seasoned - B	
	weight (g)	%	weight (g)	%	weight (g)	%
Wild rice	10	4.77	10	4.61	10	4.72
Navy bean (cargo)	20	9.52	20	9.22	20	9.43
Pinto bean	20	9.52	20	9.22	20	9.43
Black bean	20	9.52	20	9.22	20	9.43
Garlic powder	0	0	0	0	0.25	0.12
Onion powder	0	0	0	0	0.25	0.12
Black pepper powder	0	0	0	0	0.25	0.12
Cream Buds - Asia	0	0	0	0	0.6	0.28
OneGrain A30	0	0	0	0	0.5	0.24
Molasses	0	0	2	0.91	0	0
Water	140	66.67	0	0	140.15	66.11
100% Tomato juice	0	0	145	66.82	0	0
Total (per pouch)	210	100	217	100	212	100

Figure 6. The package of prototype products – Group B

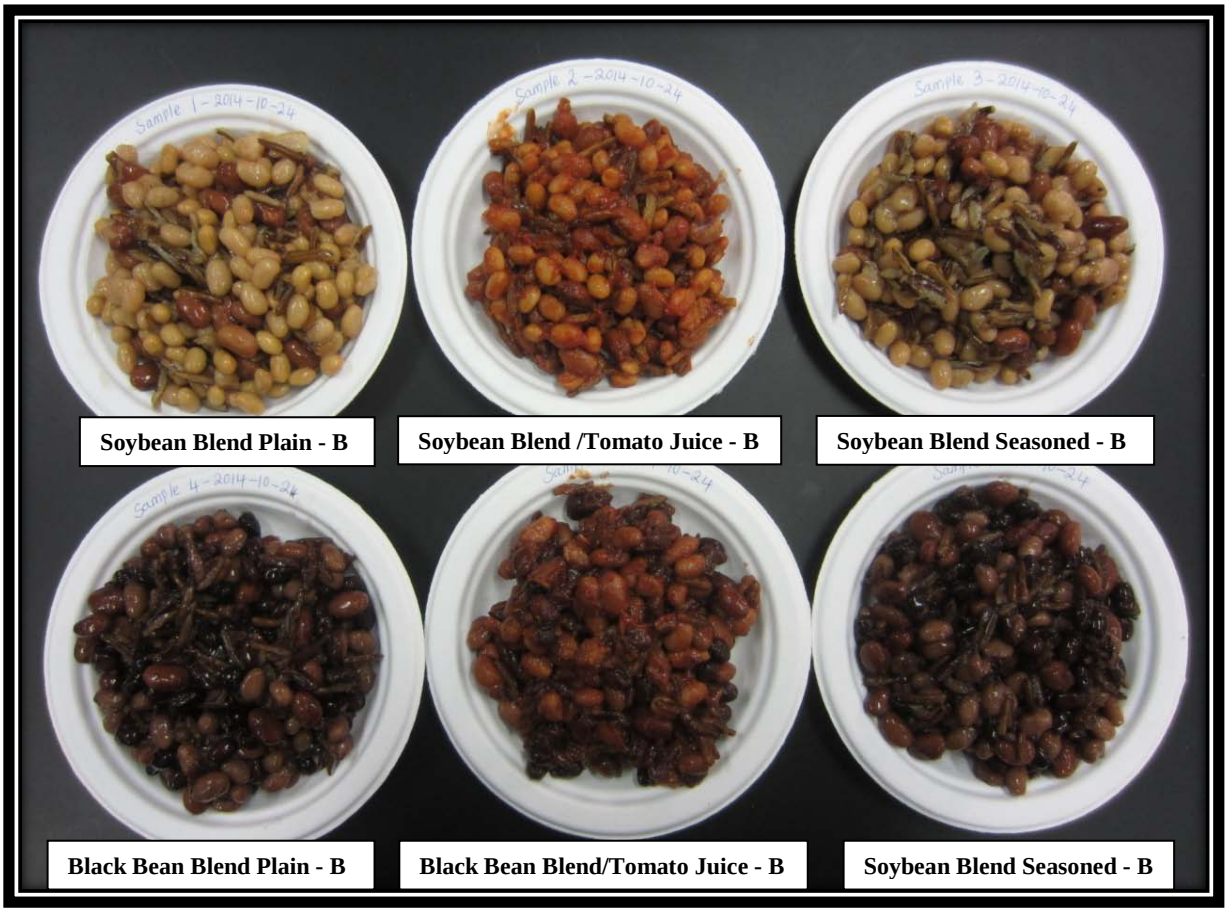


Figure 7. The appearance of prototype products – Group B

3.4 Thermal processing with retort

The goal of thermal processing is to obtain commercial sterilization by the application of heat. According to the Canadian Processed Product Regulations, SOR/82-701, s. 2 (C.R.C., c. 291 – December 15, 2014), "commercial sterility" means the condition of a food product that is free from viable forms of microorganisms, including spores, capable of growing in the food product above a temperature of 4°C.

The microorganism of greatest concern in canning industry is Clostridium botulinum (C. botulinum), a high heat resistant spore former, a gas forming anaerobe that produces a lethal toxin to human in the absence of oxygen which is known as botulism. Additionally, any spoilage microorganisms also need to be inactivated. While the thermal process is designed to destroy or inactivate these organisms, certain bacteria may survive the process, so the product is safe, but not necessarily sterile (Smith, 2011).

Sterilization value for low acid canned food (LACF) in thermal (retort) process is expressed by F_o value. The F_o value is used to compare heat sterilization treatments. A classical 'hot process' or 'minimum botulinum cook' would have a F_o value of 3 for LACF, while that for a typical commercial sterility process would be on the order of 5 to 6. There are some thermophilic organisms that are very heat stable, the F_o is on the order of thirty (Smith, 2011; Holdsworth, 1985; and Weng, 2006).

The F_o value is the number of minutes required to destroy the organism at 121.1°C. This varies with the microorganism. The F_o value also describes the amount of time required to reduce the microbial population by a factor of 10^{12}. For C. botulinum, a heating time of 2.45 minutes at 121°C reduces the population by this factor (Awuah et al, 2007; Berk, 2009; Gumerato, 2009; Holdsworth, 1985; Simson, 2008; Smith, 2011; Stumbo *et al*, 1983a & b; and Teixeira, 2012).

The target F_o for these prototype products was 20 – 30. Table 8 and Table 9 summarize the retort process recipes for Group A and Group B product respectively. The cook time was 20 mins for Group A and 30 mins for Group B.

Table 8. Steam/Spray process recipe – Group A

Segment	Time (Min.)	Temperature (°C)	PV Level (%)	System Pressure (PSI)
1. Fill			10	
2. Preheat	3	82	12	10
3. ComeUp	5	123	12	28
4. Cook	20	123	12	28
5. MicroCool	5	82	12	20
6. Cooling	10	32	12	10
7. Drain	0.5	-	-	-

Table 9. Steam/Spray process recipe – Group B

Segment	Time (Min.)	Temperature (°C)	PV Level (%)	System Pressure (PSI)
1. Fill			10	
2. Preheat	3	82	12	10
3. ComeUp	5	123	12	28
4. Cook	30	123	12	28
5. MicroCool	5	82	12	30
6. Cooling	10	32	12	10
7. Drain	0.5	-	-	-

3.5 Package examination

As shown in Figure 4 and Figure 6, throughout the entire project work, more than 300 pouches were used and processed. All pouches maintained their integrity, and no single defect that could adversely affect the hermetic seal in terms of leaking, abrasion, blister, cut, swollen was observed.

3.6 Sensory evaluations

Two sensory evaluation sessions were conducted to assess the consumer acceptability of ten ready-to-eat gluten-free meals containing pulse blends and wild rice from Group A and Group B respectively.

3.6.1 Prototype products of Group A

Table 10 showcases the average scores of each attribute for four prototype products in Group A.

Table 10. Average ranking[a] of sensory attributes for prototype products of Group A

Prototype	Sensory Attribute (1-7)				
	Overall Likeness	**Colour**	**Bean Flavour**	**Overall Flavour**	**Tenderness/ Firmness**
Soybean Plain - A	4.8	5.2	4.7	4.6	5.5
Soybean Seasoned - A	5.1	5.2	5.2	5.0	5.3
Black bean Plain - A	4.3	3.8	4.2	4.5	5.0
Black bean Seasoned - A	4.4	4.0	4.5	4.6	4.8

[a]means represent data from a 13 person panel (n=13)

Overall, the soy bean seasoned blend was most preferred by all panellists for all sensory attributes. It is important to note that both black bean blend samples scored between very much dislike to moderately like mostly due to its unappealing colour

combination and overall flavour. The least liked blend was the black bean original blend. Panelists scored the product from very much dislike (by one panelist) to moderately like. Eight out of the thirteen panelists gave the product a moderately like rating.

All panellists with the exception of one indicated an interest in purchasing the product. Five panellists (38%) stated they would purchase the original unseasoned product and commented on using their own seasoning blend. Three panellists (23%) would purchase both the original and seasoned products, however some panellists indicated they would only purchase the soybean blend.

3.6.2 Prototype products of Group B

Table 11 showcases the average scores of each attribute for six prototype products of Group B.

Table 11. Average ranking[a] of sensory attributes for prototype products of Group B

Prototype	Sensory Attribute (1-7)				
	Overall Likeness	Colour	Bean Flavour	Overall Flavour	Tenderness/ Firmness
Soy bean Plain - B	4.5	5.2	4.6	4.4	5.4
Soy bean with Tomato juice - B	5.2	5.0	5.5	5.3	5.3
Soy bean Seasoned - B	4.8	5.2	4.8	4.5	5.2
Black bean Plain - B	4.3	4.1	4.4	3.8	5.0
Black bean with Tomato juice - B	4.5	4.3	5.0	5.0	4.3
Black bean Seasoned - B	4.2	4.0	4.3	3.8	5.1

[a]means represent data from a 13 people panel (n=13)

Out of all six blends evaluated, soybean with tomato blend had the overall highest rankings for all sensory attributes. It is important to note that the soybean blends were ranked higher than the black bean blends due to appearance and overall flavour. These attributes affected the likelihood of purchase, as majority of panellists indicated they would not purchase any of the black bean blends. Overall texture rankings for all six blends were consistent between panellists. Panellists indicated inconsistency between texture of the beans, stating they were too firm or too soft, resulting in low likeness scores.

Majority of panellists stated they would purchase the seasoned blends or the plain, if packaging indicated they were required to add their own seasoning and other

ingredients. Panellists also noted that the seasonings and flavours selected for the beans were uncomplimentary to the inherent flavour of the beans.

3.6.3 Other Observations and Comments

Throughout the sensory evaluation period, several panelists indicated experiences of abdominal discomfort after each session. It is widely known that pulses and soybeans contain oligosaccharides that require a specific enzyme to be broken down. Unfortunately, humans are lacking in this enzyme, and incomplete breakdown results in bacterial activity in the small intestine. This causes intestinal gas production, as well as abdominal discomfort for a large portion of the human population (Pulse Canada, 2012).

3.7 Nutritional labelling

Figure 8 through Figure 17 illustrate the expanded Canadian nutrition fact tables with eligible Nutrient Content Claims for ten prototype products from both Group A and Group B. Over all, all of ten products have excellent nutrient profiles. They are high in fibre, low in fat and sodium, high in vitamins and minerals and have a high amount of protein.

Based on the nutrient content claims, product provides many nutrients aiding in a healthy diet. The most important claims highlight are, “High source of Fibre”, Free of sodium, Good Source of Iron, as well as stating a quantitative claim for protein, i.e. “8g of Protein per 100g serving”.

Compared to the four blends in Group A, the six blends in Group B had a slightly higher fibre and vitamin/mineral contents. The black bean plain was eligible for a free of fat claim as well.

Adding any seasoning or salt to the products will most likely void the “Free of Sodium” Claim. “Low in Sodium” claims must have less than 140mg of sodium per stated serving size and reference amount.

Nutrition Facts
Valeur nutritive

Per 1/2 cup (100 g) / par 1/2 tasse (100 g)

Amount / Teneur	% Daily Value / % valeur quotidienne
Calories / Calories 120	
Fat / Lipides 2 g	**3** %
Saturated / saturés 0.3 g + Trans / trans 0 g	**2** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 4 mg	**1** %
Potassium / Potassium 420 mg	**12** %
Carbohydrate / Glucides 19 g	**6** %
Fibre / Fibres 5 g	**20** %
Sugars / Sucres 1 g	
Protein / Protéines 8 g	
Vitamin A / Vitamine A	0 %
Vitamin C / Vitamine C	2 %
Calcium / Calcium	4 %
Iron / Fer	20 %
Vitamin K / Vitamine K	6 %
Thiamine / Thiamine	15 %
Riboflavin / Riboflavine	8 %
Niacin / Niacine	10 %
Vitamin B6 / Vitamine B6	8 %
Folate / Folate	50 %
Phosphorus / Phosphore	15 %
Magnesium / Magnésium	25 %
Zinc / Zinc	15 %
Selenium / Sélénium	6 %
Copper / Cuivre	15 %
Manganese / Manganèse	25 %

Nutrient Content Claims

- Source of energy
- Low in Fat
- Low in Saturated Fatty Acids
- Free of Trans Fatty Acids
- Free of Cholesterol
- Free of Sodium*
- High in Potassium
- High source of Fibre
- Source of Vitamin K, Riboflavin, Selenium, Niacin
- Good Source of Iron, Thiamin, Phosphorus, Copper, Zinc
- Excellent Source of Folate, Magnesium, Manganese

Figure 8. Canadian nutrition fact table for Soy Bean Original – Group A

Nutrition Facts
Valeur nutritive

Per 1/2 cup (100 g) / par 1/2 tasse (100 g)

Amount / Teneur	% Daily Value / % valeur quotidienne
Calories / Calories 120	
Fat / Lipides 0.5 g	**1** %
Saturated / saturés 0.1 g + Trans / trans 0 g	**1** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 4 mg	**1** %
Potassium / Potassium 400 mg	**11** %
Carbohydrate / Glucides 22 g	**7** %
Fibre / Fibres 5 g	**20** %
Sugars / Sucres 1 g	
Protein / Protéines 7 g	
Vitamin A / Vitamine A	0 %
Vitamin C / Vitamine C	0 %
Calcium / Calcium	4 %
Iron / Fer	10 %
Thiamine / Thiamine	15 %
Niacin / Niacine	10 %
Vitamin B6 / Vitamine B6	8 %
Folate / Folate	60 %
Phosphorus / Phosphore	10 %
Magnesium / Magnésium	25 %
Zinc / Zinc	15 %
Selenium / Sélénium	8 %
Copper / Cuivre	15 %
Manganese / Manganèse	20 %

Nutrient Content Claims

- Source of Energy
- Low in Fat
- Free of Saturated Fatty Acids
- Free of Trans Fatty Acids
- Free of Cholesterol
- Free of Sodium
- High in Potassium
- High source of Fibre
- Source of Iron, Niacin, Vitamin B6, Selenium, Phosphorus
- Good Source of Thiamine, Zinc, Copper, Manganese,
- Excellent source of Folate, Magnesium

Figure 9. Canadian nutrition fact table for Black Bean Original – Group A

Nutrition Facts Valeur nutritive Per 1/2 cup (100 g) / par 1/2 tasse (100 g)	
Amount **Teneur**	**% Daily Value** **% valeur quotidienne**
Calories / Calories 120	
Fat / Lipides 2 g	**3** %
Saturated / saturés 0.3 g + Trans / trans 0 g	**2** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 90 mg	**4** %
Potassium / Potassium 430 mg	**12** %
Carbohydrate / Glucides 19 g	**6** %
Fibre / Fibres 5 g	**20** %
Sugars / Sucres 1 g	
Protein / Protéines 8 g	
Vitamin A / Vitamine A	0 %
Vitamin C / Vitamine C	2 %
Calcium / Calcium	4 %
Iron / Fer	20 %
Vitamin K / Vitamine K	6 %
Thiamine / Thiamine	15 %
Riboflavin / Riboflavine	8 %
Niacin / Niacine	10 %
Vitamin B6 / Vitamine B6	8 %
Folate / Folate	50 %
Phosphorus / Phosphore	15 %
Magnesium / Magnésium	25 %
Zinc / Zinc	15 %
Selenium / Sélénium	6 %
Copper / Cuivre	15 %
Manganese / Manganèse	30 %

Nutrient Content Claims

- Source of Energy
- Low in Fat
- Low in Saturated Fatty Acids
- Free of Trans Fatty Acids
- Free of Cholesterol
- Low in Sodium
- Good Source of Potassium
- Very High Source of Fibre
- Source of Vitamin K, Riboflavin, Niacin, Vitamin B6, Selenium
- Good Source of Iron, Thiamine, Phosphorus, Zinc, Copper
- Excellent Source of Folate, Magnesium, Manganese

Figure 10. Canadian nutrition fact table for Soy bean with seasonings – Group A

Nutrition Facts
Valeur nutritive

Per 1/2 cup (100 g) / par 1/2 tasse (100 g)

Amount / Teneur	% Daily Value / % valeur quotidienne
Calories / Calories 120	
Fat / Lipides 0.5 g	**1** %
Saturated / saturés 0.1 g + Trans / trans 0 g	**1** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 90 mg	**4** %
Potassium / Potassium 400 mg	**11** %
Carbohydrate / Glucides 22 g	**7** %
Fibre / Fibres 5 g	**20** %
Sugars / Sucres 1 g	
Protein / Protéines 7 g	
Vitamin A / Vitamine A	0 %
Vitamin C / Vitamine C	2 %
Calcium / Calcium	4 %
Iron / Fer	10 %
Thiamine / Thiamine	15 %
Niacin / Niacine	10 %
Vitamin B6 / Vitamine B6	8 %
Folate / Folate	60 %
Phosphorus / Phosphore	10 %
Magnesium / Magnésium	25 %
Zinc / Zinc	15 %
Selenium / Sélénium	8 %
Copper / Cuivre	15 %
Manganese / Manganèse	20 %

Nutrient Content Claims

- Source of Energy
- Low in Fat
- Free of Saturated Fatty Acids
- Free of Trans Fatty Acids
- Free of Cholesterol
- Low in Sodium
- Good Source of Potassium
- High Source of Fibre
- Source of Iron, Niacin, Vitamin B6, Phosphorus, Selenium
- Good Source of Thiamine, Zinc, Copper, Manganese
- Excellent Source of Folate, Magnesium

Figure 11. Canadian nutrition fact table for black bean with seasonings – Group A

Nutrition Facts
Valeur nutritive

Per 1/2 cup (100 g) / par 1/2 tasse (100 g)

Amount / Teneur	% Daily Value / % valeur quotidienne
Calories / Calories 120	
Fat / Lipides 2 g	**3** %
Saturated / saturés 0.3 g + Trans / trans 0 g	**2** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 4 mg	**1** %
Potassium / Potassium 440 mg	**13** %
Carbohydrate / Glucides 18 g	**6** %
Fibre / Fibres 6 g	**24** %
Sugars / Sucres 1 g	
Protein / Protéines 8 g	
Vitamin A / Vitamine A	0 %
Vitamin C / Vitamine C	2 %
Calcium / Calcium	4 %
Iron / Fer	20 %
Vitamin K / Vitamine K	6 %
Thiamine / Thiamine	20 %
Riboflavin / Riboflavine	8 %
Niacin / Niacine	10 %
Vitamin B6 / Vitamine B6	8 %
Folate / Folate	60 %
Phosphorus / Phosphore	15 %
Magnesium / Magnésium	30 %
Zinc / Zinc	15 %
Selenium / Sélénium	10 %
Copper / Cuivre	20 %

Nutrient Content Claims

- Source of Energy
- Low in Fat
- Low in Saturated Fatty Acids
- Free of Trans Fatty Acids
- Free of Cholesterol
- Free of Sodium
- Good Source of Potassium
- Very High Source of Fibre
- Source of Vitamin K, Riboflavin, Selenium
- Good Source of Iron, Thiamine, Phosphorus, Zinc, Copper
- Excellent Source of Folate, Magnesium, Manganese

Figure 12. Canadian nutrition fact table for Soy blend plain - Group B

Nutrition Facts
Valeur nutritive

Per 1/2 cup (100 g) / par 1/2 tasse (100 g)

Amount / Teneur	% Daily Value / % valeur quotidienne
Calories / Calories 130	
Fat / Lipides 2 g	**3** %
Saturated / saturés 0.3 g + Trans / trans 0 g	**2** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 180 mg	**8** %
Potassium / Potassium 590 mg	**17** %
Carbohydrate / Glucides 21 g	**7** %
Fibre / Fibres 6 g	**24** %
Sugars / Sucres 4 g	
Protein / Protéines 9 g	
Vitamin A / Vitamine A	4 %
Vitamin C / Vitamine C	20 %
Calcium / Calcium	6 %
Iron / Fer	20 %
Vitamin K / Vitamine K	8 %
Thiamine / Thiamine	20 %
Riboflavin / Riboflavine	10 %
Niacin / Niacine	15 %
Vitamin B6 / Vitamine B6	10 %
Folate / Folate	60 %
Phosphorus / Phosphore	15 %
Magnesium / Magnésium	30 %
Zinc / Zinc	15 %
Selenium / Sélénium	10 %
Copper / Cuivre	20 %

Nutrient Content Claims

- Source of Energy
- Low in Fat
- Low in Saturated Fatty Acids
- Free of Trans Fatty Acids
- Free of Cholesterol
- Excellent Source of Potassium
- Very High Source of Fibre
- Source of Calcium, Vitamin K, Riboflavin, Vitamin B6, Selenium
- Good Source of Iron, Thiamine, Niacin, Phosphorus, Zinc, Copper
- Excellent Source of Folate, Magnesium, Manganese

Figure 13. Canadian nutrition fact table for soy blend with tomato juice - Group B

Nutrition Facts
Valeur nutritive

Per 1/2 cup (100 g) / par 1/2 tasse (100 g)

Amount / Teneur	% Daily Value / % valeur quotidienne
Calories / Calories 120	
Fat / Lipides 2 g	**3** %
Saturated / saturés 0.3 g + Trans / trans 0 g	**2** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 70 mg	**3** %
Potassium / Potassium 470 mg	**13** %
Carbohydrate / Glucides 19 g	**6** %
Fibre / Fibres 6 g	**24** %
Sugars / Sucres 1 g	
Protein / Protéines 8 g	
Vitamin A / Vitamine A	0 %
Vitamin C / Vitamine C	2 %
Calcium / Calcium	4 %
Iron / Fer	20 %
Vitamin K / Vitamine K	6 %
Thiamine / Thiamine	20 %
Riboflavin / Riboflavine	8 %
Niacin / Niacine	10 %
Vitamin B6 / Vitamine B6	8 %
Folate / Folate	60 %
Phosphorus / Phosphore	15 %
Magnesium / Magnésium	30 %
Zinc / Zinc	15 %
Selenium / Sélénium	10 %
Copper / Cuivre	20 %

Nutrient Content Claims

- Source of Energy
- Low in Fat
- Low in Saturated Fatty Acids
- Free of Trans Fatty Acids
- Free of Cholesterol
- Low in Sodium
- Good Source of Potassium
- Very High Source of Fibre
- Source of Vitamin K, Riboflavin, Niacin, Vitamin B6, Selenium
- Good Source of Iron, Thiamine, Phosphorus, Zinc, Copper
- Excellent Source of Folate, Magnesium, Manganese

Figure 14. Canadian nutrition fact table for Soy blend with seasoning - Group B

Nutrition Facts
Valeur nutritive

Per 1/2 cup (100 g) / par 1/2 tasse (100 g)

Amount Teneur	% Daily Value % valeur quotidienne
Calories / Calories 110	
Fat / Lipides 0.4 g	**1** %
Saturated / saturés 0.1 g + Trans / trans 0 g	**1** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 4 mg	**1** %
Potassium / Potassium 410 mg	**12** %
Carbohydrate / Glucides 21 g	**7** %
Fibre / Fibres 5 g	**20** %
Sugars / Sucres 1 g	
Protein / Protéines 7 g	
Vitamin A / Vitamine A	0 %
Vitamin C / Vitamine C	2 %
Calcium / Calcium	4 %
Iron / Fer	10 %
Thiamine / Thiamine	20 %
Niacin / Niacine	10 %
Vitamin B6 / Vitamine B6	8 %
Folate / Folate	60 %
Phosphorus / Phosphore	10 %
Magnesium / Magnésium	25 %
Zinc / Zinc	15 %
Selenium / Sélénium	8 %
Copper / Cuivre	15 %

Nutrient Content Claims

- Source of Energy
- Free of Fat
- Free of Saturated Fatty Acids
- Free of Trans Fatty Acids
- Free of Cholesterol
- Free of Sodium
- Good Source of Potassium
- High Source of Fibre
- Source of Iron, Niacin, Vitamin B6, Phosphorus, Selenium
- Good Source of Thiamine, Zinc, Copper, Manganese
- Excellent Source of Folate, Magnesium

Figure 15. Canadian nutrition fact table for black bean blend plain – Group B

Nutrition Facts
Valeur nutritive

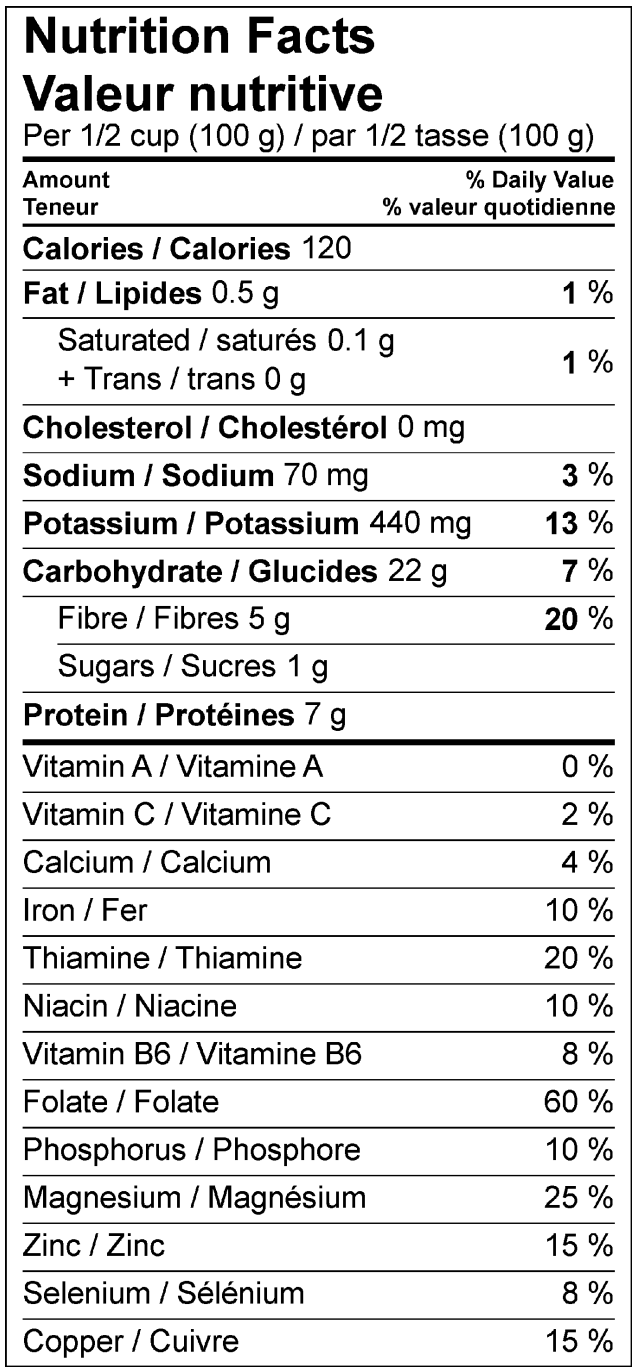
Per 1/2 cup (100 g) / par 1/2 tasse (100 g)

Amount Teneur	% Daily Value % valeur quotidienne
Calories / Calories 120	
Fat / Lipides 0.5 g	**1** %
Saturated / saturés 0.1 g + Trans / trans 0 g	**1** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 180 mg	**8** %
Potassium / Potassium 560 mg	**16** %
Carbohydrate / Glucides 24 g	**8** %
Fibre / Fibres 6 g	**24** %
Sugars / Sucres 4 g	
Protein / Protéines 7 g	
Vitamin A / Vitamine A	4 %
Vitamin C / Vitamine C	20 %
Calcium / Calcium	4 %
Iron / Fer	15 %
Thiamine / Thiamine	20 %
Riboflavin / Riboflavine	6 %
Niacin / Niacine	10 %
Vitamin B6 / Vitamine B6	10 %
Folate / Folate	60 %
Phosphorus / Phosphore	15 %
Magnesium / Magnésium	25 %
Zinc / Zinc	15 %
Selenium / Sélénium	8 %
Copper / Cuivre	15 %

Nutrient Content Claims

- Source of Energy
- Low in Fat
- Free of Saturated Fatty Acids
- Free of Trans Fatty Acids
- Free of Cholesterol
- Excellent Source of Potassium
- Very High Source of Fibre
- Source of Riboflavin, Niacin, Vitamin B6, Selenium
- Good Source of Iron, Thiamine, Phosphorus, Zinc, Copper
- Excellent Source of Folate, Magnesium, Manganese

Figure 16. Canadian nutrition fact table for black bean blend with tomato juice – Group B



Nutrition Facts
Valeur nutritive
Per 1/2 cup (100 g) / par 1/2 tasse (100 g)

Amount / Teneur	% Daily Value / % valeur quotidienne
Calories / Calories 120	
Fat / Lipides 0.5 g	**1** %
Saturated / saturés 0.1 g + Trans / trans 0 g	**1** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 70 mg	**3** %
Potassium / Potassium 440 mg	**13** %
Carbohydrate / Glucides 22 g	**7** %
Fibre / Fibres 5 g	**20** %
Sugars / Sucres 1 g	
Protein / Protéines 7 g	
Vitamin A / Vitamine A	0 %
Vitamin C / Vitamine C	2 %
Calcium / Calcium	4 %
Iron / Fer	10 %
Thiamine / Thiamine	20 %
Niacin / Niacine	10 %
Vitamin B6 / Vitamine B6	8 %
Folate / Folate	60 %
Phosphorus / Phosphore	10 %
Magnesium / Magnésium	25 %
Zinc / Zinc	15 %
Selenium / Sélénium	8 %
Copper / Cuivre	15 %

Nutrient Content Claims

- Source of Energy
- Low in Fat
- Free of Saturated Fatty Acids
- Free of Trans Fatty Acids
- Free of Cholesterol
- Low in Sodium
- Good Source of Potassium
- High Source of Fibre
- Source of Iron, Niacin, Vitamin B6, Phosphorus, Selenium
- Good Source of Thiamine, Zinc, Copper, Manganese
- Excellent Source of Folate, Magnesium

Figure 17. Canadian nutrition fact table for bean blend with seasoning – Group B

4.0. CONCLUSIONS AND RECOMMENDATIONS

In this study ten pulse-based gluten-free shelf-stable ready-to-eat meal prototype products in retort pouches were developed through retort processing. The products all have acceptable sensory profiles, containing a mixture of edible beans, soybeans, and wild rice along with other natural food ingredients. These outcomes can be used by growers and processors such as Shoal Lake Wild Rice as a marketing tool to promote pulses into new markets and applications.

Development of innovative food products from pulses will benefit growers, processors, and health-conscious consumers. Results from this research can facilitate marketing, technology transfer, and public awareness of the functional and health benefits of pulses. This may further result in increased farm profitability for Manitoba pulse and legume growers leading to increased production, economic activities and job creation.

FDC is not currently recognized as a Process Authority for thermal process development, therefore the Temperature Distribution Test and Heat Penetration Test may need to be carried out by an experienced and CFIA recognized Process Authority, in order to develop a HACCP program for small or large scale commercial production.

It is recommended to move forward with the soybean blend and determine which market to position the product. Food service and restaurants would benefit from the soybean original blend as they would be proficient enough to add their own seasonings, while an improved seasoned soybean blend would be adequate for retail. Improvements in consistency of texture amongst all beans should also be considered.

A more attractive packaging label or converting to a retort cup may improve likeness of the product and increase market appeal. It is also recommended to market the product as a side dish or full meal based on the panellists' remarks. Highlights of nutritional benefits and claims should also be considered to improve marketability of the product.

Additional processing steps such as tempering, soaking and blanching the raw beans prior to retorting can be investigated in order to reduce the incidence of abdominal discomfort (flatulence) by consumers.

5.0. ACKNOWLEDGEMENTS

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Appendix A. Recipe report for Group A

ICON Recipe Report

Product Code: RTE MEAL **Revision:** 4 **Created Date:** 9/16/2014 1:41:45 PM **By:** jq **Recipe Type:** Experimental

Description: SA STEAM/SPRAY Test Recipe

Comments: MPGA PROJECT TEST

Procs Mode: Steam / Spray **Container:** POUCH 4 OZ **Qty:** 20 **Motion:** Rocking - Angle:10

☑ User Inputs | User Input Intervals | ☐ Process Table | ☑ Initial Temp | Auto IT: .0

Interval 1 %	Interval 2 %	Interval 3 %
50	N / A	N / A

Segment Parameters

Seg # 1	**SS Fill**						
PV Level	10 %	Segment Hold	0	PG #1	0	PG #2	0
PG #3	0						
Seg # 2	**SS Preheat**						
PV Temperature	82.0 C	System Pressure	10.0 PSI	PV Level	12 %	Rotor Speed	6.0 CPM
Segment Minutes	3 MIN	Segment Seconds	0 SEC	Segment Hold	0	PG #1	0
PG #2	0	PG #3	0				
Seg # 3	**SS ComeUp**						
PV Temperature	123.0 C	PV Temp Ramp	7.8 DPM	System Pressure	28.0 PSI	System Press Ramp	3.0 PPM
PV Level	12 %	Flow	78 GPM	Rotor Speed	6.0 CPM	Segment Minutes	5 MIN
Segment Seconds	0 SEC	Segment Hold	0	PG #1	0	PG #2	0
PG #3	0						
Seg # 4	**SS Cook**						
PV Temperature	123.0 C	PV Temp Ramp	0.0 DPM	System Pressure	28.0 PSI	System Press Ramp	0.0 PPM
PV Level	12 %	Flow	78 GPM	Rotor Speed	6.0 CPM	Segment Minutes	20 MIN
Segment Seconds	0 SEC	Segment Hold	0	PG #1	0	PG #2	0
PG #3	0						
Seg # 5	**SS MicroCool**						
PV Temperature	82.0 C	PV Temp Ramp	7.8 DPM	System Pressure	30.0 PSI	System Press Ramp	0.4 PPM
PV Level	12 %	Rotor Speed	6.0 CPM	Segment Minutes	5 MIN	Segment Seconds	0 SEC
Segment Hold	0	PG #1	0	PG #2	0	PG #3	0
Seg # 6	**SS Cooling**						
PV Temperature	32.0 C	PV Temp Ramp	10.0 DPM	System Pressure	10.0 PSI	System Press Ramp	4.0 PPM
PV Level	12 %	Rotor Speed	6.0 CPM	Segment Minutes	10 MIN	Segment Seconds	0 SEC
Segment Hold	0	PG #1	0	PG #2	0	PG #3	0
Seg # 7	**SS Drain**						
System Pressure	0.0 PSI	Rotor Speed	0.0 CPM	Segment Minutes	0 MIN	Segment Seconds	30 SEC
Segment Hold	0	PG #1	0	PG #2	0	PG #3	0

Alarm Parameters

Phase: SS Fill	Parameter	Upper Deviation Tolerance	Lower Deviation Tolerance	Alarm Delay	Alarm Enabled
	PV Level	2.0	3.0	300	☑

Phase: SS Preheat	Parameter	Upper Deviation Tolerance	Lower Deviation Tolerance	Alarm Delay	Alarm Enabled
	PV Temperature	5.0	5.0	300	☑
	System Pressure	5.0	5.0	6	☑
	PV Level	2.0	3.0	6	☑
	Rotor Speed	1.0	1.0	6	☑

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Appendix B. Recipe report for Group B

ICON Recipe Report

Product Code: RTE MEAL **Revision:** 5 **Created Date:** 10/7/2014 10:05:40 AM **By:** jq **Recipe Type:** Experimental

Description: SA STEAM/SPRAY Test Recipe

Comments: MPGA PROJECT TEST

Proca Mode: Steam / Spray **Container:** POUCH 4 OZ **Qty:** 20 **Motion:** Rocking - Angle:10

☑ User Inputs | User Input Intervals | ☐ Process Table | ☑ Initial Temp | Auto IT: .0

Interval 1 %	Interval 2 %	Interval 3 %
50	N / A	N / A

Segment Parameters

Seg # 1	**SS Fill**						
PV Level	10 %	Segment Hold	0	PG #1	0	PG #2	0
PG #3	0						
Seg # 2	**SS Preheat**						
PV Temperature	82.0 C	System Pressure	10.0 PSI	PV Level	12 %	Rotor Speed	6.0 CPM
Segment Minutes	3 MIN	Segment Seconds	0 SEC	Segment Hold	0	PG #1	0
PG #2	0	PG #3	0				
Seg # 3	**SS ComeUp**						
PV Temperature	123.0 C	PV Temp Ramp	7.8 DPM	System Pressure	28.0 PSI	System Press Ramp	3.0 PPM
PV Level	12 %	Flow	78 GPM	Rotor Speed	6.0 CPM	Segment Minutes	5 MIN
Segment Seconds	0 SEC	Segment Hold	0	PG #1	0	PG #2	0
PG #3	0						
Seg # 4	**SS Cook**						
PV Temperature	123.0 C	PV Temp Ramp	0.0 DPM	System Pressure	28.0 PSI	System Press Ramp	0.0 PPM
PV Level	12 %	Flow	78 GPM	Rotor Speed	6.0 CPM	Segment Minutes	30 MIN
Segment Seconds	0 SEC	Segment Hold	0	PG #1	0	PG #2	0
PG #3	0						
Seg # 5	**SS MicroCool**						
PV Temperature	82.0 C	PV Temp Ramp	7.8 DPM	System Pressure	30.0 PSI	System Press Ramp	0.4 PPM
PV Level	12 %	Rotor Speed	6.0 CPM	Segment Minutes	5 MIN	Segment Seconds	0 SEC
Segment Hold	0	PG #1	0	PG #2	0	PG #3	0
Seg # 6	**SS Cooling**						
PV Temperature	32.0 C	PV Temp Ramp	10.0 DPM	System Pressure	10.0 PSI	System Press Ramp	4.0 PPM
PV Level	12 %	Rotor Speed	6.0 CPM	Segment Minutes	10 MIN	Segment Seconds	0 SEC
Segment Hold	0	PG #1	0	PG #2	0	PG #3	0
Seg # 7	**SS Drain**						
System Pressure	0.0 PSI	Rotor Speed	0.0 CPM	Segment Minutes	0 MIN	Segment Seconds	30 SEC
Segment Hold	0	PG #1	0	PG #2	0	PG #3	0

Alarm Parameters

Phase: SS Fill	Parameter	Upper Deviation Tolerance	Lower Deviation Tolerance	Alarm Delay	Alarm Enabled
	PV Level	2.0	3.0	300	☑
Phase: SS Preheat	**Parameter**	**Upper Deviation Tolerance**	**Lower Deviation Tolerance**	**Alarm Delay**	**Alarm Enabled**
	PV Temperature	5.0	5.0	300	☑
	System Pressure	5.0	5.0	6	☑
	PV Level	2.0	3.0	6	☑
	Rotor Speed	1.0	1.0	6	☑

Printed: 12/12/2014 09:24:17 Page 1 of 2

Appendix C. Temperature distribution test report

LEAD LOCATION INFORMATION

Generated by CALSoft 5.0.5 © 2014 TechniCAL Inc
Date Printed: Monday, December 15, 2014 3:07:20 pm

CONTAINER : Pouch-N/A-N/A
RETORT : Horizontal- Water Spray-SSA/APR-95-1
RETORT SETUP : Layered-9 Layers-Divider Sheets-1 Baskets
PROCESSOR : FDC
LOCATION : PLP
TEST DATE/TIME : 8/8/2014 2:11:57 PM
NOTES : setup system, 1st run after leaking issue resolved
FILE NAME : C:\Users\Jiancheng Qi\AppData\Roaming\TCAL\CALSoft 5\Data\14080803.ctd

Channel Number	TID Or Basket #?	Layer	Top View
01	1	1	A
02	1	8	B
03	1	6	D
04	1	7	C
05	1	5	A
06	1	2	B
07	1	3	A
08	1	4	D
09	1	4	B
10	1	2	D
11	1	1	E
12	1	3	E
13	1	8	D
14	1	7	C
15	1	5	E
16	1	6	B

FOOD DEVELOPMENT CENTRE
Growing Opportunities in Food

DATA COLLECTION REPORT

Generated by CALSoft 5.0.5 © 2014 TechniCAL Inc
Date Printed: Monday, December 15, 2014 3:05:16 pm

CONTAINER	: Pouch-N/A-N/A
RETORT	: Horizontal- Water Spray-SSA/APR-95-1
RETORT SETUP	: Layered-9 Layers-Divider Sheets-1 Baskets
PROCESSOR	: FDC
LOCATION	: PLP
TEST DATE/TIME	: 8/8/2014 2:11:57 PM
NOTES	: setup system, 1st run after leaking issue resolved
FILE NAME	: C:\Users\Jiancheng Qi\AppData\Roaming\TCAL\CALSoft 5\Data\14080803.ctd

THERMOCOUPLES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
TYPE	FL	FL	FL	FL	FL	FL	FL	FL	FL	FL	FL	FL	FL	FL	FL	FL
CALIB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(hh:mm:ss)																
00:00:00	29.91	31.68	31.64	31.35	30.92	29.77	30.74	30.89	30.65	30.38	29.88	31.01	31.86	31.87	31.26	31.12
00:00:15	29.96	31.72	31.67	31.41	30.95	29.79	30.79	30.92	30.69	30.44	29.91	31.04	31.90	31.92	31.29	31.17
00:00:30	42.01	40.20	41.44	39.24	39.42	40.96	39.51	39.54	37.16	38.97	41.12	41.16	40.64	39.55	38.40	38.22
00:00:46	47.70	47.83	48.98	47.42	47.43	48.26	48.01	45.72	44.03	45.46	46.51	46.39	46.72	45.76	44.56	44.66
00:01:00	53.28	53.65	54.51	53.12	52.86	53.80	53.34	53.40	51.61	52.98	54.18	54.01	54.19	53.51	52.17	52.15
00:01:15	58.43	58.38	59.47	58.14	58.22	58.89	58.81	58.52	57.25	58.22	59.24	58.98	59.22	58.58	57.38	57.64
00:01:31	64.62	63.39	64.16	62.94	63.05	63.81	63.51	63.34	62.14	62.94	63.93	63.76	63.92	63.34	62.27	62.34
00:01:45	69.15	69.39	70.14	68.91	69.14	69.77	69.62	69.29	68.34	68.96	68.53	68.33	68.53	67.97	66.98	67.03
00:02:00	73.48	73.71	74.51	73.22	73.39	74.02	73.83	73.66	72.38	73.42	74.06	73.98	74.18	73.68	72.68	72.83
00:02:15	77.65	77.29	78.55	77.42	77.61	78.12	77.94	77.81	76.78	77.56	78.17	78.04	78.28	77.78	76.80	77.17
00:02:31	82.71	82.54	83.29	81.36	81.74	82.23	82.13	81.73	80.91	81.56	82.14	82.07	82.17	81.77	80.87	81.18
00:02:45	83.89	83.33	84.72	82.89	83.79	83.84	84.72	83.28	83.21	82.53	83.88	83.66	84.26	81.69	81.51	81.73
00:03:00	81.78	81.47	81.63	81.93	82.01	81.77	81.84	81.63	82.26	81.94	81.83	81.64	81.72	81.87	82.04	82.07
00:03:16	82.39	82.61	82.57	83.12	83.50	83.17	83.32	82.66	83.61	82.75	82.89	82.79	82.35	83.14	82.81	83.33
00:03:30	81.46	81.23	82.59	81.54	81.53	81.54	81.48	81.47	81.74	81.56	81.64	81.48	81.33	81.54	81.61	81.66
00:03:46	82.77	82.54	82.51	82.87	83.23	82.93	82.78	82.66	83.23	82.63	82.95	82.72	82.68	82.88	82.74	83.01
00:04:01	81.86	81.64	81.74	81.91	81.91	81.84	81.82	81.82	82.01	81.87	81.99	81.79	81.73	81.82	81.88	81.91
00:04:15	81.21	81.17	81.26	81.34	81.33	81.32	81.32	81.31	81.39	81.34	81.45	81.26	81.19	81.33	81.29	81.33
00:04:30	82.73	82.43	82.68	82.74	82.70	82.64	82.66	82.77	83.34	83.12	83.18	83.12	83.07	82.96	82.56	82.91
00:04:46	81.91	81.77	81.86	81.95	81.90	81.89	81.84	81.91	82.02	81.92	82.01	81.87	81.83	81.88	81.90	81.93
00:05:00	81.58	81.43	81.51	81.59	81.58	81.55	81.52	81.58	81.57	81.59	81.73	81.52	81.49	81.53	81.56	81.57
00:05:16	81.22	81.17	81.24	81.30	81.29	81.27	81.28	81.29	81.31	81.28	81.41	81.25	81.23	81.31	81.24	81.27
00:05:31	81.07	80.95	81.06	81.09	81.02	81.18	81.06	81.12	81.07	81.16	81.32	81.07	81.04	81.07	81.06	81.09
00:05:45	82.07	81.76	82.03	81.50	81.72	83.21	81.90	81.64	82.10	82.07	83.06	82.42	81.39	81.41	82.26	82.08
00:06:01	85.96	84.89	85.08	84.11	84.69	85.64	84.56	84.46	84.54	85.16	86.82	86.06	84.25	84.10	85.46	84.61
00:06:15	89.32	89.61	89.66	88.50	87.94	89.23	88.22	88.77	87.79	88.72	90.08	89.57	88.52	88.41	88.95	88.43
00:06:30	90.33	90.39	90.53	90.37	90.14	90.91	90.29	90.52	90.49	90.47	91.29	90.99	90.17	89.99	90.52	90.32
00:06:46	90.97	90.94	91.05	90.82	90.73	91.64	90.93	90.93	91.23	91.09	92.14	91.72	90.56	90.68	91.60	91.21
00:07:00	92.79	92.20	92.62	92.00	91.92	92.94	92.11	92.34	92.31	92.47	94.57	93.48	91.86	91.93	93.28	92.30
00:07:15	96.17	96.31	96.76	95.91	95.92	97.00	94.95	95.91	94.63	95.84	97.61	96.86	95.21	95.12	96.56	94.83
00:07:31	97.99	98.13	98.35	98.16	97.76	98.67	98.02	98.32	98.12	98.27	99.97	99.37	97.92	98.04	99.03	98.16
00:07:45	99.02	99.12	99.51	99.25	98.82	99.68	99.07	99.39	99.38	99.43	100.90	100.50	98.85	99.08	100.27	99.33
00:08:01	101.02	100.56	101.04	100.47	100.14	101.16	100.38	100.86	100.67	100.77	102.62	101.88	100.27	100.42	101.56	100.67
00:08:16	103.20	103.21	104.29	103.09	102.79	103.86	103.14	103.50	103.34	102.93	105.17	104.12	102.41	102.47	103.62	102.56
00:08:30	105.04	105.11	105.65	105.03	104.69	105.67	104.96	105.54	105.16	105.44	107.08	106.46	104.91	104.96	105.92	105.11
00:08:46	106.99	106.94	107.12	107.01	106.56	108.24	106.83	107.08	107.14	107.24	108.74	108.19	106.60	106.78	107.91	107.15
00:09:00	110.26	109.99	108.88	108.98	109.16	111.63	109.52	108.71	110.59	109.07	111.40	110.58	108.41	108.71	110.31	110.31
00:09:15	112.41	112.57	112.01	112.26	111.78	113.60	112.08	111.88	112.92	112.17	114.00	113.09	111.33	111.33	112.84	112.08
00:09:31	113.77	114.06	113.46	113.72	113.33	114.82	113.59	113.42	114.41	113.63	115.22	114.83	113.21	113.53	114.64	114.17
00:09:45	114.92	115.23	114.73	115.04	114.45	116.04	114.73	114.71	115.51	115.02	116.75	116.16	114.52	114.75	116.02	115.32
00:10:01	117.44	117.66	116.96	117.22	116.16	117.99	116.59	116.31	117.28	116.67	118.56	117.97	116.08	116.26	117.82	117.17
00:10:15	119.31	119.57	119.08	119.42	118.77	120.43	119.09	119.14	119.70	119.34	121.26	120.76	118.84	118.50	119.89	119.10

FOOD DEVELOPMENT CENTRE
Growing Opportunities in Food

LETHAL RATE REPORT

Generated by CALSoft 5.0.5 © 2014 TechniCAL Inc
Date Printed: Monday, December 15, 2014 3:08:00 pm

CONTAINER	: Pouch-N/A-N/A
RETORT	: Batch-Horizontal-WaterSpray-SSA/APR-95
PROCESSOR	: FDC
LOCATION	: PLP
OTHER INFO	: setup system, 1st run after leaking issue resolved
CALSOFT FILE	: C:\Users\Jiancheng Qi\AppData\Roaming\TCAL\CALSoft 5\Data\14080803.ctd

z Value **10.00 deg. C**

Reference Temp **121.11 deg. C**

Lead Number **01**

Process Time (HH:MM:SS)	Temperature (deg C)	Lethal Rate	Cumulated F (min)
00:00:00	29.91	0.000	0.00
00:00:15	29.96	0.000	0.00
00:00:30	42.01	0.000	0.00
00:00:46	47.70	0.000	0.00
00:01:00	53.28	0.000	0.00
00:01:15	58.43	0.000	0.00
00:01:31	64.62	0.000	0.00
00:01:45	69.15	0.000	0.00
00:02:00	73.48	0.000	0.00
00:02:15	77.65	0.000	0.00
00:02:31	82.71	0.000	0.00
00:02:45	83.89	0.000	0.00
00:03:00	81.78	0.000	0.00
00:03:16	82.39	0.000	0.00
00:03:30	81.46	0.000	0.00
00:03:46	82.77	0.000	0.00
00:04:01	81.86	0.000	0.00
00:04:15	81.21	0.000	0.00
00:04:30	82.73	0.000	0.00
00:04:46	81.91	0.000	0.00
00:05:00	81.58	0.000	0.00
00:05:16	81.22	0.000	0.00
00:05:31	81.07	0.000	0.00
00:05:45	82.07	0.000	0.00
00:06:01	85.96	0.000	0.00
00:06:15	89.32	0.001	0.00
00:06:30	90.33	0.001	0.00
00:06:46	90.97	0.001	0.00
00:07:00	92.79	0.001	0.00
00:07:15	96.17	0.003	0.00
00:07:31	97.99	0.005	0.00
00:07:45	99.02	0.006	0.00
00:08:01	101.02	0.010	0.01
00:08:16	103.20	0.016	0.01
00:08:30	105.04	0.025	0.01
00:08:46	106.99	0.039	0.02
00:09:00	110.26	0.082	0.04
00:09:15	112.41	0.135	0.06
00:09:31	113.77	0.185	0.11
00:09:45	114.92	0.240	0.16
00:10:01	117.44	0.430	0.25
00:10:15	119.31	0.661	0.37

ACCUMULATED F

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Date Printed: Monday, December 15, 2014 3:08:40 pm

CONTAINER	: Pouch-N/A-N/A
RETORT	: Batch-Horizontal-WaterSpray-SSA/APR-95
PROCESSOR	: FDC
LOCATION	: PLP
OTHER INFO	: setup system, 1st run after leaking issue resolved
CALSOFT FILE	: C:\Users\Jiancheng Qi\AppData\Roaming\TCAL\CALSoft 5\Data\14080803.ctd

z Value	: 10.00 deg. C
Reference Temp	: 121.11 deg. C
RT	: 121.11 deg. C
Process Temp Reached Time	: 00:00:00 minutes
Heating Time (including CUT)	: 00:29:15 minutes

Sorted by Total F Ascending

	Lead Type	Location Information				IT (deg C)	Heating F (min)	Cooling F (min)	Total F (min)
		Type	Basket	Layer	Top View				
05	Free	Basket	1	5	A	30.92	4.08	0.00	4.08
13	Free	Basket	1	8	D	31.86	4.18	0.00	4.18
01	Free	Basket	1	1	A	29.91	4.19	0.00	4.19
07	Free	Basket	1	3	A	30.74	4.21	0.00	4.21
14	Free	Basket	1	7	C	31.87	4.27	0.00	4.27
03	Free	Basket	1	6	D	31.64	4.31	0.00	4.31
10	Free	Basket	1	2	D	30.38	4.37	0.00	4.37
08	Free	Basket	1	4	D	30.89	4.39	0.00	4.39
04	Free	Basket	1	7	C	31.35	4.41	0.00	4.41
16	Free	Basket	1	6	B	31.12	4.42	0.00	4.42
02	Free	Basket	1	8	B	31.68	4.45	0.00	4.45
09	Free	Basket	1	4	B	30.65	4.58	0.00	4.58
06	Free	Basket	1	2	B	29.77	4.61	0.00	4.61
15	Free	Basket	1	5	E	31.26	4.66	0.00	4.66
12	Free	Basket	1	3	E	31.01	4.74	0.00	4.74
11	Free	Basket	1	1	E	29.88	4.87	0.00	4.87

Values of 999.00 indicate that the F vlaue is greater than 1000.
The General Method Estimated Process Times include the Test Come-Up Time.

The General Method F values listed above are calculated in CALSoft using the Trapezoidal Method with the factors z= 10.00 deg. C and Tref=121.11 deg. C.

T.D. SUMMARY INFORMATION

Generated by CALSoft 5.0.5 © 2014 TechniCAL Inc
Date Printed: Monday, December 15, 2014 3:09:17 pm

FILE NAME : C:\Users\Jiancheng Qi\AppData\Roaming\TCAL\CALSoft 5\Data\14080803.ctd

Container **Pouch-N/A-N/A**
Filled With **Other-n/a**
Controller **Stock ICON RMS**
Retort Type **Horizontal- Water Spray-SSA/APR-95-1**

Processor **FDC**
Location **PLP**
Set Point **0**
Steam Head Press **120**
Retort Setup **Layered-9 Layers-Divider Sheets-1 Baskets**

Target Process Temp **121.11**
Total Time **00:29:15**
Time Enter Cool

Total Scans / Time **118**
Heating/Cooling **118/0**

Test Date/Time **8/8/2014 2:11:57 PM**
Person Collecting Test **JQ**
Reason for Test **TD**

	Time	MIG	Chart	RTD	Slow Lead	Slow Temp	Temp Type =C
Process Temp		0.0	0.0	0.0	01	0.00	
Cook Start		0.0	0.0	0.0	01	0.00	

	Location Information						
Lead	Mig Or Basket	Basket	Layer	Top View	Reached Target Vent Temp At	Reached Target Process Temp At	Total f
01	Basket	1	1	A	00:09:00		4.19
02	Basket	1	8	B	00:09:00	00:10:30	4.45
03	Basket	1	6	D	00:09:00		4.31
04	Basket	1	7	C	00:09:00	00:10:46	4.41
05	Basket	1	5	A	00:09:00		4.08
06	Basket	1	2	B	00:08:46	00:10:30	4.61
07	Basket	1	3	A	00:09:00		4.21
08	Basket	1	4	D	00:09:00		4.39
09	Basket	1	4	B	00:09:00	00:10:30	4.58
10	Basket	1	2	D	00:08:46		4.37
11	Basket	1	1	E	00:08:46	00:10:15	4.87
12	Basket	1	3	E	00:08:46	00:10:30	4.74
13	Basket	1	8	D	00:09:00		4.18
14	Basket	1	7	C	00:09:00	00:10:46	4.27
15	Basket	1	5	E	00:08:46	00:10:30	4.66
16	Basket	1	6	B	00:09:00	00:10:30	4.42

Appendix D. Heat penetration test report fro Group A

DATA COLLECTION REPORT

Generated by CALSoft 5.0.5 © 2014 TechniCAL Inc
Date Printed: Monday, December 15, 2014 11:44:40 am

PRODUCT	: formuila 1 & 2 & 3 & 4
CONTAINER	: Pouch-Gold Retort pouch 4OZ-145mmX200mm
RETORT	: Horizontal- Water Spray-SSA/APR-95
PROCESSOR	: FDC
LOCATION	: Portage la Prairie
TEST DATE/TIME	: 9/18/2014 1:06:55 PM
NOTES	:
FILE NAME	: C:\Users\Jiancheng Qi\AppData\Roaming\TCAL\CALSoft 5\Data\14091801.chp

	THERMOCOUPLES											
	1	2	4	5	6	7	8	9	10	11	12	14
TYPE	FL	FL	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
CALIB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(hh:mm:ss)												
00:00:00	56.26	55.57	35.44	33.84	29.84	29.27	31.96	31.98	31.91	29.48	31.21	28.69
00:00:15	60.74	61.57	39.39	39.25	34.23	33.18	36.66	37.22	36.13	33.87	35.50	31.63
00:00:30	64.66	65.08	43.37	43.03	38.43	36.80	40.70	40.57	39.89	37.54	39.59	36.16
00:00:45	68.41	69.48	46.54	47.41	42.21	40.54	44.77	45.00	44.33	41.43	43.69	40.46
00:01:00	72.76	74.34	51.81	52.27	47.88	44.54	48.79	49.63	48.15	44.75	48.07	44.98
00:01:15	76.50	77.75	55.44	57.12	51.74	49.43	54.23	55.22	54.09	50.17	53.76	50.63
00:01:30	79.87	80.65	59.03	60.69	56.60	54.17	58.24	58.81	58.45	54.45	57.56	55.06
00:01:45	80.24	82.12	64.07	64.45	61.02	58.69	62.41	62.72	62.86	58.18	61.85	58.64
00:02:00	78.79	79.29	67.27	67.42	64.56	63.67	66.10	66.56	65.68	62.13	64.67	62.28
00:02:15	81.16	81.61	69.72	69.33	66.34	66.92	68.26	68.75	69.02	65.84	67.73	65.53
00:02:30	84.29	85.00	71.61	71.55	69.39	70.09	70.37	70.66	71.62	68.54	70.02	68.01
00:02:45	88.71	89.42	73.73	73.84	72.26	73.23	73.26	72.97	74.25	71.64	72.49	70.56
00:03:00	90.58	92.29	77.16	77.26	76.36	77.17	76.93	76.73	78.13	75.13	76.03	73.46
00:03:15	92.33	94.63	80.27	79.41	78.49	80.06	79.06	79.32	80.23	77.84	78.73	76.19
00:03:30	95.50	96.52	82.06	81.87	80.82	83.25	81.73	81.74	82.79	80.43	81.36	78.87
00:03:45	97.26	98.86	85.67	84.56	83.97	86.23	84.26	84.37	85.79	83.03	83.93	80.98
00:04:00	99.66	100.84	87.92	87.20	87.93	88.67	87.27	87.40	88.68	86.22	87.31	84.00
00:04:15	101.29	102.18	90.96	89.69	89.97	91.18	89.51	90.61	91.39	88.70	90.07	86.36
00:04:30	102.56	102.90	92.53	91.84	92.37	93.33	91.90	92.72	93.66	90.94	92.44	88.58
00:04:45	103.82	105.08	95.17	94.53	95.13	95.92	94.73	95.33	96.12	92.78	94.34	90.56
00:05:00	105.97	106.93	96.96	96.08	97.74	97.84	96.53	97.26	98.11	95.31	96.54	93.25
00:05:15	108.36	110.41	98.24	97.84	99.42	99.81	98.30	99.26	99.98	97.28	98.46	95.35
00:05:30	111.63	112.53	101.28	100.40	101.98	102.36	100.39	101.51	102.02	99.43	100.56	97.61
00:05:45	112.73	113.49	104.49	103.26	105.21	105.11	103.36	104.57	105.10	102.14	103.51	100.43
00:06:00	114.13	114.84	106.26	105.03	107.14	107.19	105.52	106.63	106.92	104.22	105.51	102.36
00:06:15	116.24	116.88	108.83	106.89	109.67	109.11	107.34	108.48	108.92	106.03	107.52	104.40
00:06:30	118.64	119.82	110.28	109.36	112.41	111.88	109.26	110.53	110.72	107.89	109.36	106.36
00:06:45	120.81	121.74	112.96	111.63	114.23	114.07	111.94	113.20	113.21	110.57	111.96	109.02
00:07:00	122.43	123.01	115.03	113.71	116.10	116.03	114.09	115.37	115.28	112.81	114.07	110.96
00:07:15	123.01	123.23	116.08	115.39	118.07	117.59	116.05	117.17	116.90	115.13	115.95	112.84
00:07:30	122.88	122.98	117.82	116.99	119.23	119.11	118.03	118.89	118.47	116.73	117.32	114.49
00:07:45	122.55	122.54	119.41	117.86	119.81	119.82	119.04	119.79	119.81	118.68	118.80	116.17
00:08:00	122.20	122.17	120.03	118.50	120.10	120.33	119.76	120.40	120.48	119.46	119.51	117.33
00:08:15	121.84	121.80	119.57	118.91	120.50	120.58	120.28	120.79	120.87	119.97	120.02	117.96
00:08:30	121.73	121.72	120.62	119.41	120.71	120.87	120.68	121.11	121.14	120.53	120.49	118.57
00:08:45	121.68	121.67	121.09	119.68	120.91	121.01	120.93	121.23	121.24	120.79	120.71	119.20
00:09:00	121.69	121.69	121.08	120.01	121.02	121.12	121.09	121.33	121.39	121.05	120.90	119.48
00:09:15	121.71	121.71	121.07	120.24	121.22	121.22	121.24	121.43	121.49	121.18	121.05	119.81
00:09:30	121.77	121.75	121.36	120.37	121.32	121.32	121.38	121.55	121.58	121.42	121.22	120.20
00:09:45	121.76	121.74	120.62	120.58	121.42	121.39	121.43	121.61	121.67	121.43	121.31	120.42
00:10:00	121.79	121.76	121.47	120.73	121.48	121.45	121.54	121.64	121.71	121.53	121.41	120.59
00:10:15	121.76	121.75	121.55	120.83	121.54	121.51	121.57	121.69	121.73	121.67	121.49	120.75

FOOD DEVELOPMENT CENTRE
Growing Opportunities in Food

CRITICAL FACTORS INFORMATION

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Date Printed: Monday, December 15, 2014 11:49:01 am

PRODUCT : formuila 1 & 2 & 3 & 4
CONTAINER : Pouch-Gold Retort pouch 4OZ-145mmX200mm
RETORT : Horizontal- Water Spray-SSA/APR-95
PROCESSOR : FDC
LOCATION : Portage la Prairie
TEST DATE/TIME : 9/18/2014 1:06:55 PM
NOTES :
FILE NAME : C:\Users\Jiancheng Qi\AppData\Roaming\TCAL\CALSoft 5\Data\14091801.chp

#	TC Position GC	Location	Orientation	Custom1 grams	Custom2 grams	Custom3 grams	Custom4 grams	Custom5 grams
04								
05								
06								
07								
08								
09								
10								
11								
12								
14								

#	Tare Weight grams	Gross Weight grams	Net Weight grams	Drain Weight grams	Residual Gas oo	Particle Size inches	Pre-Impale	Post-Impale
04							False	False
05							False	False
06							False	False
07							False	False
08							False	False
09							False	False
10							False	False
11							False	False
12							False	False
14							False	False

#	Pre-Headspace (Gross) 32nds/inch	Pre-Headspace (Temp) F	Post-Headspace (Gross) 32nds/inch	Post-Headspace (Temp) F	Pre pH	Post pH	Pre Viscosity centipoise	Post Viscosity centipoise
04								
05								
06								
07								
08								
09								
10								
11								
12								
14								

FOOD DEVELOPMENT CENTRE
Growing Opportunities in Food

LETHAL RATE REPORT

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Date Printed: Monday, December 15, 2014 11:51:35 am

PRODUCT	: **formuila 1 & 2 & 3 & 4**
CONTAINER	: Pouch-Gold Retort pouch 4OZ-145mmX200mm
RETORT	: Batch-Horizontal-WaterSpray-SSA/APR-95
PROCESSOR	: FDC
LOCATION	: Portage la Prairie
OTHER INFO	:
CALSOFT FILE	: C:\Users\Jiancheng Qi\AppData\Roaming\TCAL\CALSoft 5\Data\14091801.chp

z Value **10.00 deg. C**

Reference Temp **121.11 deg. C**

Lead Number **01**

Process Time (HH:MM:SS)	Temperature (deg C)	Lethal Rate	Cumulated F (min)
00:00:00	56.26	0.000	0.00
00:00:15	60.74	0.000	0.00
00:00:30	64.66	0.000	0.00
00:00:45	68.41	0.000	0.00
00:01:00	72.76	0.000	0.00
00:01:15	76.50	0.000	0.00
00:01:30	79.87	0.000	0.00
00:01:45	80.24	0.000	0.00
00:02:00	78.79	0.000	0.00
00:02:15	81.16	0.000	0.00
00:02:30	84.29	0.000	0.00
00:02:45	88.71	0.001	0.00
00:03:00	90.58	0.001	0.00
00:03:15	92.33	0.001	0.00
00:03:30	95.50	0.003	0.00
00:03:45	97.26	0.004	0.00
00:04:00	99.66	0.007	0.00
00:04:15	101.29	0.010	0.01
00:04:30	102.56	0.014	0.01
00:04:45	103.82	0.019	0.01
00:05:00	105.97	0.031	0.02
00:05:15	108.36	0.053	0.03
00:05:30	111.63	0.113	0.05
00:05:45	112.73	0.145	0.08
00:06:00	114.13	0.200	0.13
00:06:15	116.24	0.326	0.19
00:06:30	118.64	0.566	0.30
00:06:45	120.81	0.933	0.49
00:07:00	122.43	1.355	0.78
00:07:15	123.01	1.549	1.14
00:07:30	122.88	1.503	1.52
00:07:45	122.55	1.393	1.88
00:08:00	122.20	1.285	2.22
00:08:15	121.84	1.183	2.53
00:08:30	121.73	1.153	2.82
00:08:45	121.68	1.140	3.11
00:09:00	121.69	1.143	3.39
00:09:15	121.71	1.148	3.68
00:09:30	121.77	1.164	3.97
00:09:45	121.76	1.161	4.26
00:10:00	121.79	1.169	4.55

FOOD DEVELOPMENT CENTRE
Growing Opportunities in Food

ACCUMULATED F

Generated by CALSoft 5.0.5 © 2014 TechniCAL Inc
Date Printed: Monday, December 15, 2014 11:53:10 am

PRODUCT	: **formuila 1 & 2 & 3 & 4**
CONTAINER	: Pouch-Gold Retort pouch 4OZ-145mmX200mm
RETORT	: Batch-Horizontal-WaterSpray-SSA/APR-95
PROCESSOR	: FDC
LOCATION	: Portage la Prairie
OTHER INFO	:
CALSOFT FILE	: C:\Users\Jiancheng Qi\AppData\Roaming\TCAL\CALSoft 5\Data\14091801.chp

z Value	: 10.00 deg. C
Reference Temp	: 121.11 deg. C
RT	: 121.11 deg. C
Come-Up Time	: 00:07:00 minutes
Heating Time (including CUT)	: 00:42:45 minutes

Sorted by Total F Ascending

	Lead Type	IT (deg C)	Heating F (min)	Cooling F (min)	Total F (min)
05	TC	33.84	19.18	0.00	19.18
14	TC	28.69	21.12	0.00	21.12
04	TC	35.44	21.55	0.00	21.55
07	TC	29.27	22.04	0.00	22.04
06	TC	29.84	22.43	0.00	22.43
12	TC	31.21	22.46	0.00	22.46
08	TC	31.96	22.64	0.00	22.64
09	TC	31.98	22.85	0.00	22.85
11	TC	29.48	22.99	0.00	22.99
10	TC	31.91	23.24	0.00	23.24
02	Free	55.57	23.82	0.00	23.82
01	Free	56.26	23.90	0.00	23.90

Values of 999.00 indicate that the F vlaue is greater than 1000.
The General Method Estimated Process Times include the Test Come-Up Time.

The General Method F values listed above are calculated in CALSoft using the Trapezoidal Method with the factors z= 10.00 deg. C and Tref=121.11 deg. C.

FOOD DEVELOPMENT CENTRE
Growing Opportunities in Food

H.P. SUMMARY INFORMATION

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Date Printed: Monday, December 15, 2014 11:54:09 am

FILE NAME : C:\Users\Jiancheng Qi\AppData\Roaming\TCAL\CALSoft 5\Data\14091801.chp

Product	formuila 1 & 2 & 3 & 4	Processor	FDC
Container	Pouch-Gold Retort pouch 4OZ-145mmX200mm	Location	Portage la Prairie
Retort Type	Horizontal- Water Spray-SSA/APR-95		

Target RT	121.11	Total Scans	172	Test Date/Time	9/18/2014 1:06:55 PM
Target F	12.00	Heating/Cooling	172/0	Person Collecting Test	JQ
Temp Type	C	Time Enter Cool		Reason for Test	trial for F1 & 2 (Plain) 3&4 (seasoned)

Lead	Reached Target RT at Time
01	00:07:00
02	00:06:45

Lead	TCPosition	Reached Target F at	Heat F	Cool F	Total F
04		00:19:00	21.55	0	21.55
05		00:20:15	19.18	0	19.18
06		00:18:15	22.43	0	22.43
07		00:18:30	22.04	0	22.04
08		00:18:30	22.64	0	22.64
09		00:18:15	22.85	0	22.85
10		00:18:00	23.24	0	23.24
11		00:18:30	22.99	0	22.99
12		00:18:45	22.46	0	22.46
14		00:19:45	21.12	0	21.12

Appendix E. Consumer acceptability sensory results for Group A

Sample Code	Panellist	Colour Combination	Bean Flavour Combination	Overall Flavour	Tenderness/Firmness	Overall Likeness
A	1	5	5	4	6	5
A	2	6	6	5	7	6
A	3	5	5	5	6	5
A	4	6	6	6	5	6
A	5	6	6	6	6	6
A	6	6	4	4	5	5
A	7	4	2	2	5	3
A	8	5	4	4	6	4
A	9	5	4	5	5	4
A	10	6	5	5	5	5
A	11	5	5	5	4	4
A	12	4	4	4	5	4
A	13	5	5	5	6	5
Average		5.2	4.7	4.6	5.5	4.8
S. Dev.		0.7250	1.1094	1.0439	0.7763	0.9268
Mode		5	5	5	5	5
Avg. Mode (%)		46.2%	38.5%	46.2%	46.2%	38.5%

Sample Code	Panellist	Colour Combination	Bean Flavour Combination	Overall Flavour	Tenderness/Firmness	Overall Likeness
B	1	3	5	4	3	4
B	2	3	4	5	6	5
B	3	3	3	3	6	3
B	4	2	3	4	4	3
B	5	5	5	6	6	5
B	6	5	5	5	5	5
B	7	3	2	2	4	2
B	8	4	4	5	6	5
B	9	4	5	5	6	5
B	10	4	5	5	5	5
B	11	4	5	5	5	5
B	12	5	4	4	4	4
B	13	4	5	5	5	5
Average		3.8	4.2	4.5	5.0	4.3
S. Dev.		0.9268	1.0127	1.0500	1.0000	1.0316
Mode		4	5	5	6	5
Avg. Mode (%)		38.5%	53.8%	53.8%	38.5%	61.5%

Sample Code	Panellist	Colour Combination	Bean Flavour Combination	Overall Flavour	Tenderness/Firmness	Overall Likeness
C	1	5	5	3	6	5
C	2	6	6	6	7	6
C	3	5	5	5	6	5
C	4	6	6	4	4	5
C	5	6	4	5	5	5
C	6	6	4	3	5	3
C	7	4	5	5	5	5
C	8	5	7	7	4	6
C	9	5	5	5	6	5
C	10	6	5	5	5	5
C	11	5	5	6	5	5
C	12	4	4	5	5	5
C	13	5	6	6	6	6
Average		5.2	5.2	5.0	5.3	5.1
S. Dev.		0.7250	0.8987	1.1547	0.8549	0.7596
Mode		5	5	5	5	5
Avg. Mode (%)		46.2%	46.2%	46.2%	46.2%	69.2%

Sample Code	Panellist	Colour Combination	Bean Flavour Combination	Overall Flavour	Tenderness/Firmness	Overall Likeness
D	1	3	5	5	5	5
D	2	3	5	5	6	5
D	3	3	3	3	6	3
D	4	2	3	4	3	2
D	5	5	5	5	5	5
D	6	5	5	3	5	3
D	7	3	3	3	4	3
D	8	5	5	5	4	5
D	9	5	6	6	6	6
D	10	4	5	6	5	5
D	11	4	5	4	5	4
D	12	5	4	5	4	5
D	13	5	5	6	5	6
Average		4.0	4.5	4.6	4.8	4.4
S. Dev.		1.0801	0.9674	1.1209	0.8987	1.2609
Mode		5	5	5	5	5
Avg. Mode (%)		46.2%	61.5%	38.5%	46.2%	46.2%

Appendix F. Consumer acceptability sensory results for Group B

Soybean Plain							
Sample Code	Panellist	Colour	Bean Flavour	Overall Flavour	Tenderness	Overall Likeness	Purchase?
82	151	5	5	4	6	5	2
82	289	6	6	6	7	6	2
82	342	5	5	5	5	5	1
82	438	5	3	3	3	3	1
82	461	5	4	4	5	5	2
82	468	4	5	3	6	3	1
82	491	6	5	6	6	6	2
82	543	6	5	5	5	5	2
82	723	5	4	4	6	4	1
82	786	5	4	4	3	3	1
82	792	5	5	4	6	5	1
82	799	5	5	5	6	5	2
82	826	6	4	4	6	4	2
Average		5.2	4.6	4.4	5.4	4.5	1.5
S. Dev.		0.5991	0.7679	0.9608	1.1929	1.0500	0.5189
Mode		5	5	4	6	5	2
Soybean Tomato							
Sample Code	Panellist	Colour	Bean Flavour	Overall Flavour	Tenderness	Overall Likeness	Purchase?
93	151	6	5	5	6	5	2
93	289	6	7	7	7	7	2
93	342	4	5	4	6	4	1
93	438	3	5	6	5	5	2
93	461	6	5	5	5	5	2
93	468	4	5	5	5		2
93	491	5	6	6	6	6	2
93	543	6	6	6	5	6	2
93	723	4	5	3	6	4	1
93	786	4	6	6	6	6	2
93	792	6	6	5	5	5	2
93	799	5	5	6	4	5	2
93	826	6	5	5	3	4	1
Average		5.0	5.5	5.3	5.3	5.2	1.8
S. Dev.		1.0801	0.6602	1.0316	1.0316	0.9374	0.4385
Mode		6	5	5	6	5	2

Soybean Seasoned

Sample Code	Panellist	Colour	Bean Flavour	Overall Flavour	Tenderness	Overall Likeness	Purchase?
23	151	4	5	5	4	4	1
23	289	5	6	6	6	6	2
23	342	6	6	5	6	6	2
23	438	5	3	3	5	3	1
23	461	5	5	5	5	5	2
23	468	6	5	2	3		1
23	491	5	6	6	6	6	2
23	543	6	5	5	6	5	2
23	723	3	4	4	6	4	1
23	786	5	3	3	5	3	1
23	792	6	5	5	5	5	2
23	799	6	5	5	5	5	2
23	826	6	5	4	6	5	2
Average		5.2	4.8	4.5	5.2	4.8	1.6
S. Dev.		0.9268	0.9871	1.1983	0.9268	1.0553	0.5064
Mode		6	5	5	6	5	2

Black Bean Tomato

Sample Code	Panellist	Colour	Bean Flavour	Overall Flavour	Tenderness	Overall Likeness	Purchase?
31	151	5	5	3	3	3	1
31	289	5	4	5	3	3	1
31	342	4	6	6	6	6	2
31	438	5	5	5	6	5	2
31	461	4	5	6	6	6	2
31	468	3	6	6	3	6	2
31	491	4	5	5	6	5	2
31	543	4	5	5	4	4	1
31	723	5	5	5	3	5	2
31	786	4	5	5	5	5	1
31	792	4	4	4	3	3	1
31	799	4	5	5	5	5	1
31	826	5	5	5	3	3	1
Average		4.3	5.0	5.0	4.3	4.5	1.5
S. Dev.		0.6304	0.5774	0.8165	1.3775	1.1983	0.5189
Mode		4	5	5	3	5	1

Black Bean Plain							
Sample Code	Panellist	Colour	Bean Flavour	Overall Flavour	Tenderness	Overall Likeness	Purchase?
38	151	4	4	4	4	4	1
38	289	5	5	6	6	6	2
38	342	6	5	4	5	5	1
38	438	3	4	3	3	3	1
38	461	4	4	4	4	4	1
38	468	2	3	1	6		1
38	491	5	5	5	5	5	
38	543	5	5	4	5	5	2
38	723	5	5	4	5	4	1
38	786	3	3	2	4	3	1
38	792	3	5	4	6	4	1
38	799	5	5	5	6	5	2
38	826	3	4	4	6	4	2
Average		4.1	4.4	3.8	5.0	4.3	1.3
S. Dev.		1.1875	0.7679	1.2810	1.0000	0.8876	0.4924
Mode		5	5	4	6	4	1

Black Bean Seasoned							
Sample Code	Panellist	Colour	Bean Flavour	Overall Flavour	Tenderness	Overall Likeness	Purchase?
53	151	4	4	3	5	4	1
53	289	5	4	3	5	3	1
53	342	5	5	5	6	5	1
53	438	2	4	4	5	4	1
53	461	5	5	5	5	5	2
53	468	2	3	3	6	3	1
53	491	5	5	5	6	5	2
53	543	4	4	4	5	4	1
53	723	5	5	4	5	4	1
53	786	4	3	3	3	3	1
53	792	3	4	3	4	4	1
53	799	5	5	4	6	5	1
53	826	3	5	4	5	5	2
Average		4.0	4.3	3.8	5.1	4.2	1.2
S. Dev.		1.1547	0.7511	0.8006	0.8623	0.8006	0.4385
Mode		5	5	3	5	4	1