Healthy flour and sound margins

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Introduction

Market share challenges

Market share of a range of bread products, especially white breads is on the decline in the cereal based food products market. Competitive low carb, no carb and gluten free products are impacting the sales volume alarmingly in some markets.

Introduction cont'd

Confusion with gluten free

While gluten free products are meant to cater to a small segment of population that suffer from gluten intolerance, often such claims create confusion among general population leading most consumers to believe that gluten free is healthy and of higher quality.

Introduction cont'd

Low carb popularity

Low carb and no carb stemmed largely from the period of once very popular Atkins diet for weight control. Although faded many years ago it seems to have left some lasting impression still affecting the industry.

Introduction cont'd

Wheat carbs – conspicuous target

Although weight control related issues leading to obesity involve multiple factors carb, especially from wheat based products si readily identified as contributing factor and seems to be the conspicuous target for most health critics and media.

Introduction cont'd

Rising health care costs

Obesity has been a burning issue of discussion among multi disciplines engaged in the food industry and public health administration. Rising health care costs associated with health complications related to obesity has become a major concern for many governments around the world.

Enhancing flour nutrition incorporating nutrition rich cereals

Enhancing nutritive value of flour incorporating processed nutrition rich cereals and/or legumes is an excellent way of serving the needs of the market place while maintaining the core flour grades for conventional products. This is achievable in an existing flour mill with minimal investment.

The paper deals with technical aspects of processing these in the form of whole grains or in fractions for end use applications.

Enhancing flour nutrition maintaining functionality

Produce whole grain flour from field crops that have the good nutritional attributes providing targeted health benefits and are either neutral or add to functionality of the resultant flour for various types of end use applications

Targeted nutritional attributes

- Total dietary fibre
  - Soluble fibre
  - Insoluble fibre
- Omega-3
- β-glucan
- Phyto nutrients
- Anti oxidants
- Low fat
- Low glycemic index
- Whole grain flour

Commonly available field crops

- Food barley
  - Low amylose
  - Regular
  - High amylose
- Pulses
  - Peas
  - Lentils
  - Beans
- Buckwheat
- Flax

Nutritive values of various field crops

Food barley

Barley is an excellent source of beta-glucan, contains antioxidants, vitamins, minerals and phytonutrients such as phenolic acids and lignans. These components have biochemical activities that can reduce the risk of coronary heart disease, diabetes, and certain types of cancers. As a whole grain, barley can play a role in weight maintenance. Barley also contributes to satiety.

Health Benefits Associated With Barley

- Reduces the risk of coronary heart disease
- May reduce the risk of developing type-2 diabetes and shows a favorable effect on blood glucose and insulin levels
- May have a protective effect against certain types of cancer
- Can play a role in weight management

Food barley

Content of β-glucans in Cereals

Cereal	β-glucans,%
Barley	
Hulled, normal starch	3.9 - 5.1
Hulless, normal starch	3.4 - 4.7
Hulless, waxy starch	6.8 - 9.7
Hulless, zero amylose	9.0 – 10.0
Hulless, high amylose	7.0 - 9.0
Oats	2.7 - 8.0
Rye	1.2 – 3.0
Wheat	0.4 – 1.4

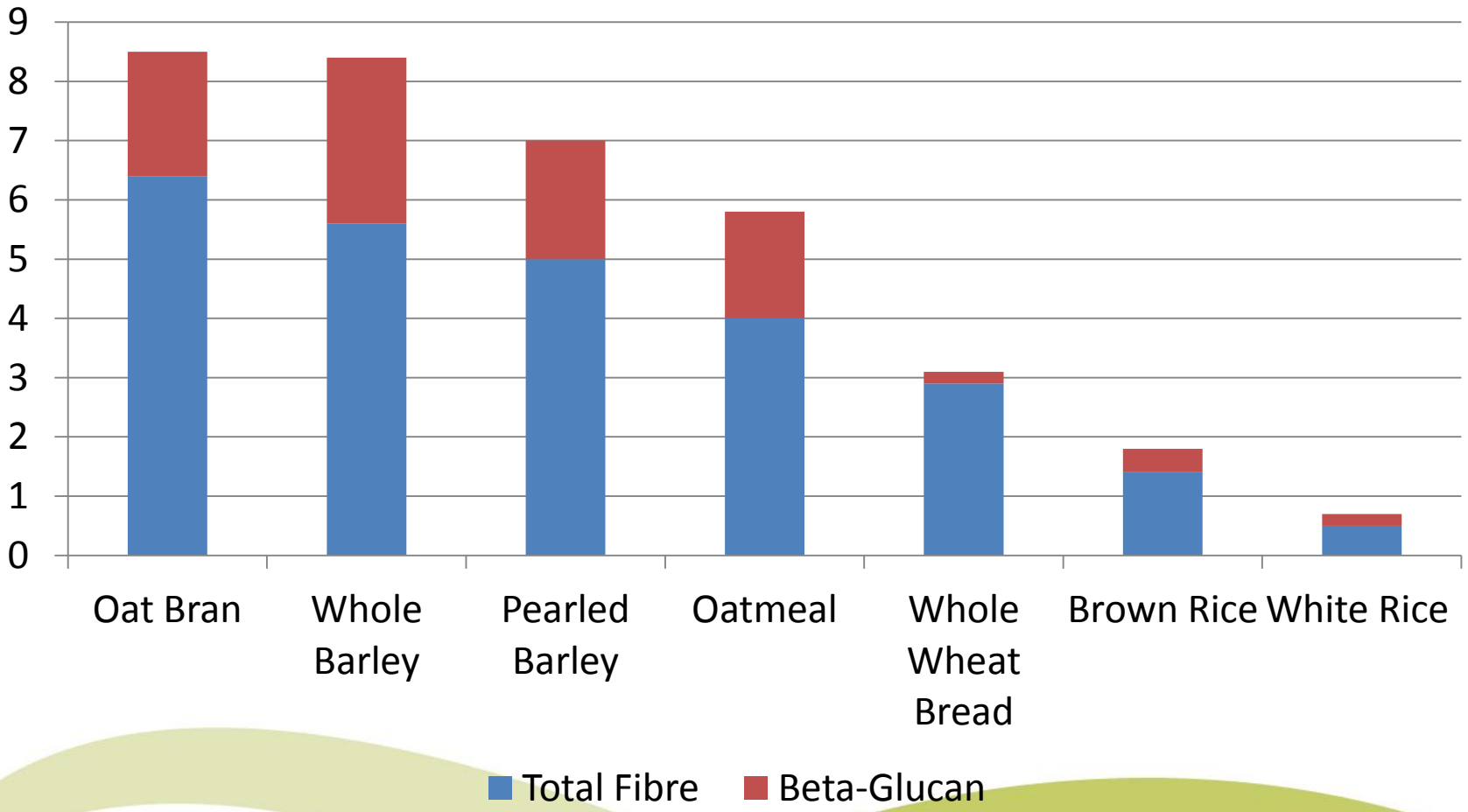
Reference: Izydorczyk, 2008; CIGI, 2008

Food barley

Health claim

The recent USA and now in Canada diet-health claim for foods containing barley will encourage food manufacturers to use barley ingredients in their products.

Grams of fibre/40g serving



Pulses

Nutritional Properties of Pulses

- Pulses are higher in ***protein*** than most other plant foods with about twice the protein content of cereal grains.
- They are rich in the amino acid lysine but limiting in the sulphur-containing amino acids methionine, cysteine and cystine thereby complementing the amino acid pattern found in cereals.

Nutritional Properties of Pulses

- Good source of complex carbohydrates including soluble and insoluble dietary fibre.
- Contain 60-70% total carbohydrates including both resistant starch and oligosaccharides both of which can act as prebiotics.
- The glycemic index of pulses is very low compared to other carbohydrate rich foods.

Nutritional Properties of Pulses

- Good sources of iron, zinc, magnesium, calcium, selenium, potassium, and phosphorus.
- Excellent source of B vitamins especially folate.
- They are low in fat.
- Also contain beneficial antioxidants that may reduce the risk of certain diseases and promote overall human health.

Health Benefits Associated with Pulses

- There is strong evidence from epidemiological studies that the consumption of pulses can play a role in preventing cardiovascular disease and diabetes as well as improving gut health.
- Emerging research suggests that when consumed regularly, pulses may help with weight loss and weight regulation.

Composition (g/100g dry matter)

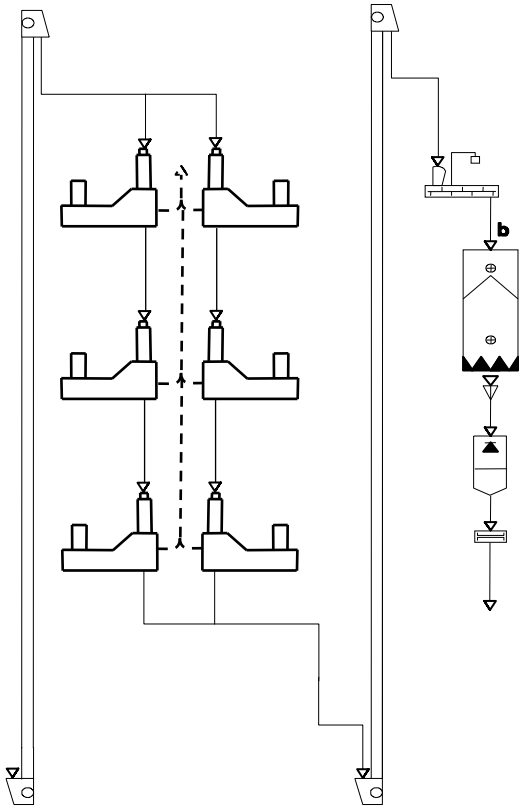
Grain Type	Protein	Fat	Carbohydrate	Fibre
Peas	25	1	60	26
Beans*	21-23	1-1.5	60-63	15-25
Lentils	26	1	60	31
Chickpeas	19	6	61	17
White Rice	7	1	80	1
Brown Rice	8	3	77	4
Wheat	15	2	68	12
Oats	17	7	66	11

Source: USDA National Nutrient Database for Standard Reference
*Includes: Kidney, black, cranberry, pinto and navy beans

Milling properties of various field crops

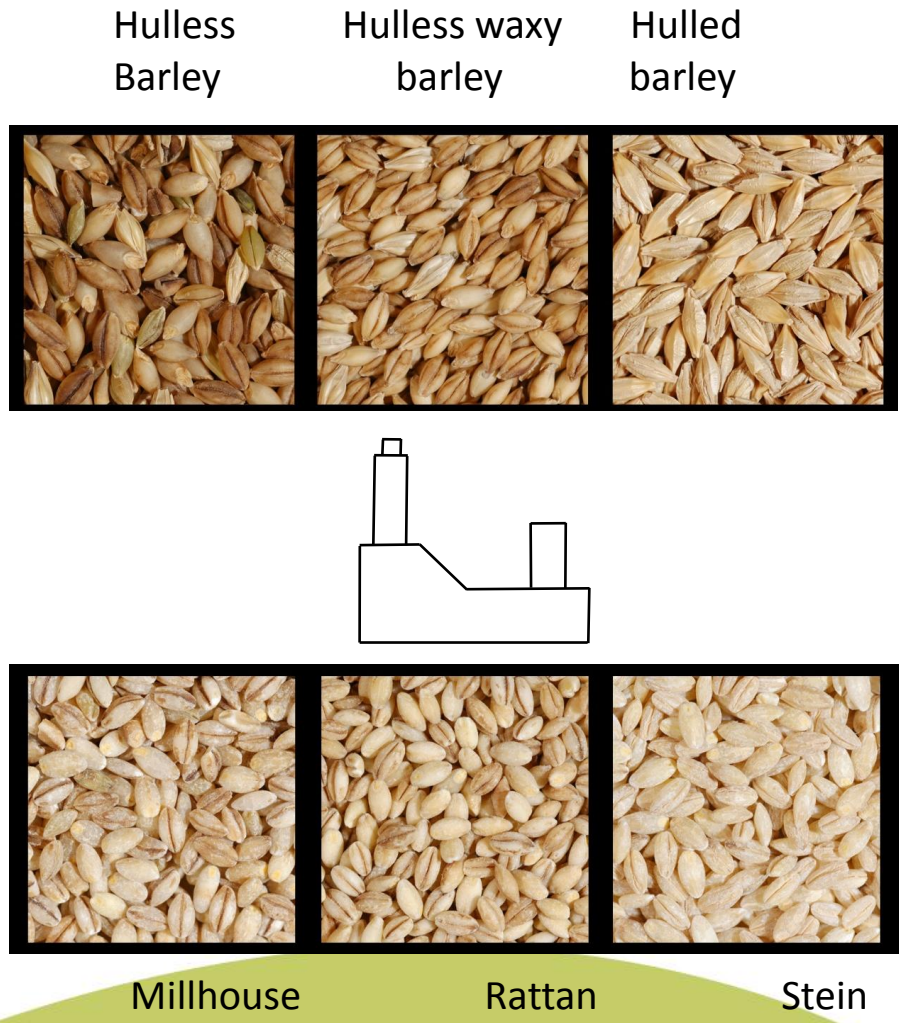
Food barley – Milling process

Barley has been traditionally milled to produce pot and pearled barley. Barley has also been milled into semolina and flour in various regions of the world for various ethnically diverse food recipes. Barley used in all of these processes were hulled therefore required shelling and pearling.



Food barley – Milling process

Important development influencing the renewed interest in barley as a food ingredient is the development of hulless barley varieties with zero (waxy), low (partial waxy), regular and high amylose contents. Hulless cultivars permit greater ease in milling and pearling with higher processing yields.



Food barley – Milling process

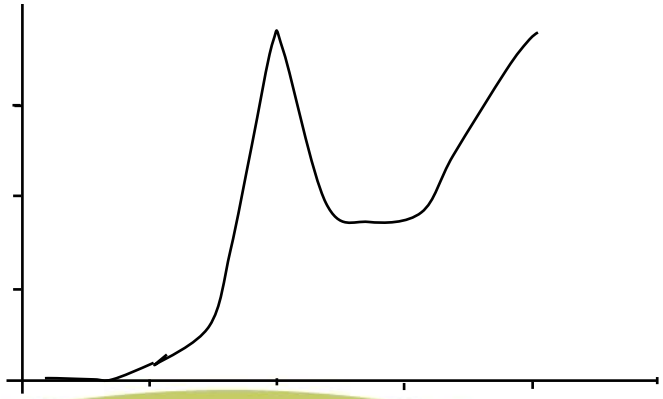
Development of hulless barley has helped in processing barley in flour mills directly without having to use pearling machine at the front end.

It also has helped in increasing process yields

Milling and food application potential of barley

Availability of a wide range of barley types varying in polysaccharide content, especially in beta-glucan and also varying in starch pasting profile, is advantageous to food manufacturers as it allows for barley ingredients with varying functionality and nutrient content.

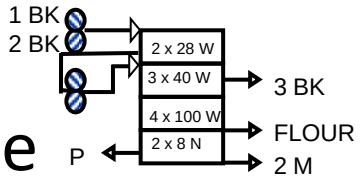
RVA – Pasting curve for HB flour

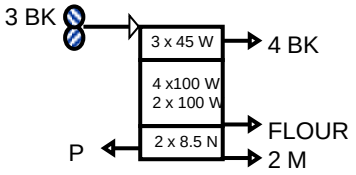


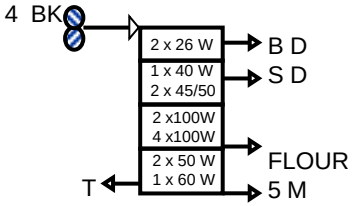
HB 100%

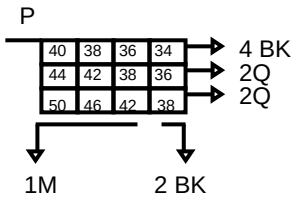
Milling & processing properties of barley

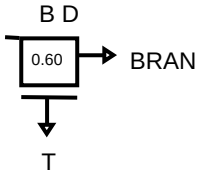
HB barley varieties with varying degree of amylose content however does have an influence on milling performance and on processing characteristics requiring appropriate processing diagrams

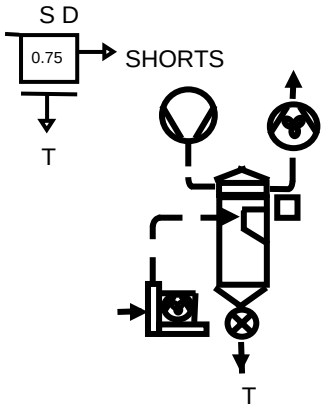


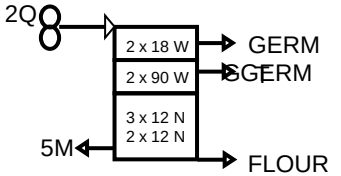


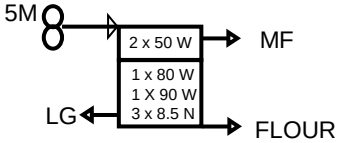


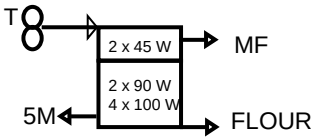


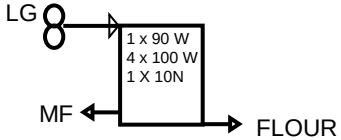






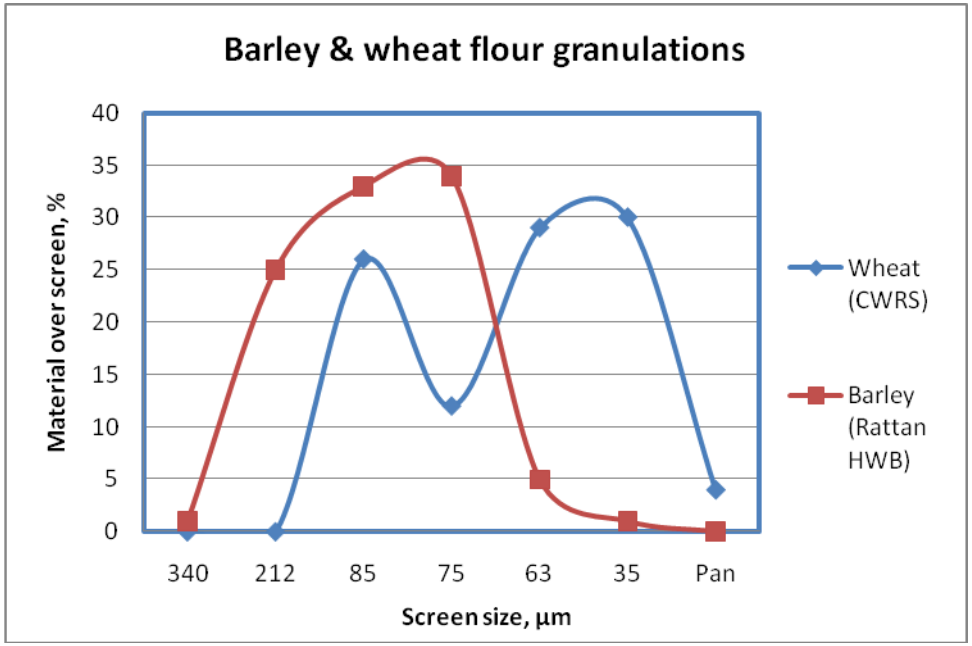






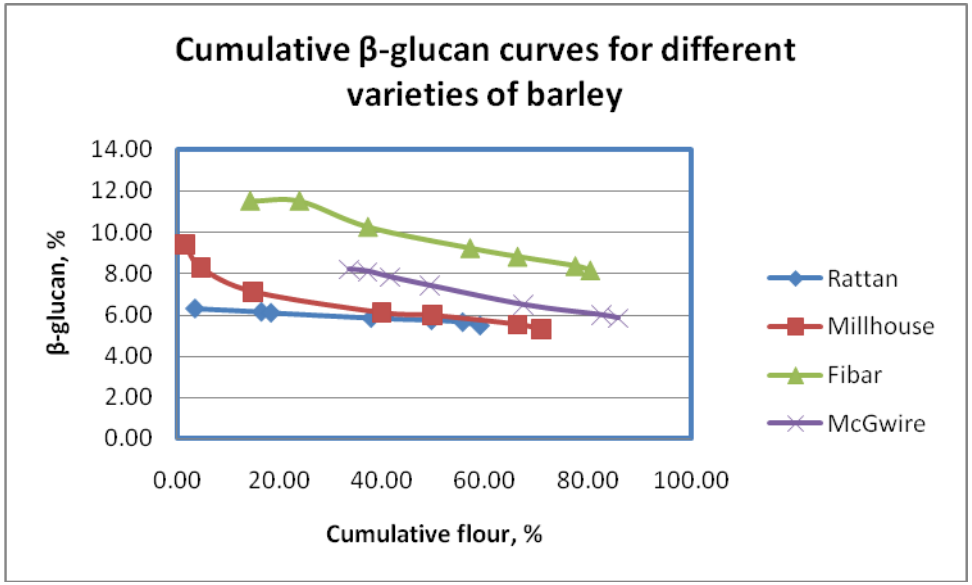
Milling & processing properties of barley

Due to its soft milling nature flour sieve covers are kept relatively more open to allow free flowing of material. This leads to flour particle size to be coarser



Milling & processing properties of barley

Since beta-glucan is of importance a cumulative beta-glucan chart provides a quick reference to these levels at a defined extraction levels.



Milling wheat and barley blend

Milling wheat and barley blend

Pulses – Milling process

Pulses – Milling process

Hammer Mill (HM)

Pin Mill (PM)

Stone Mill (SM)

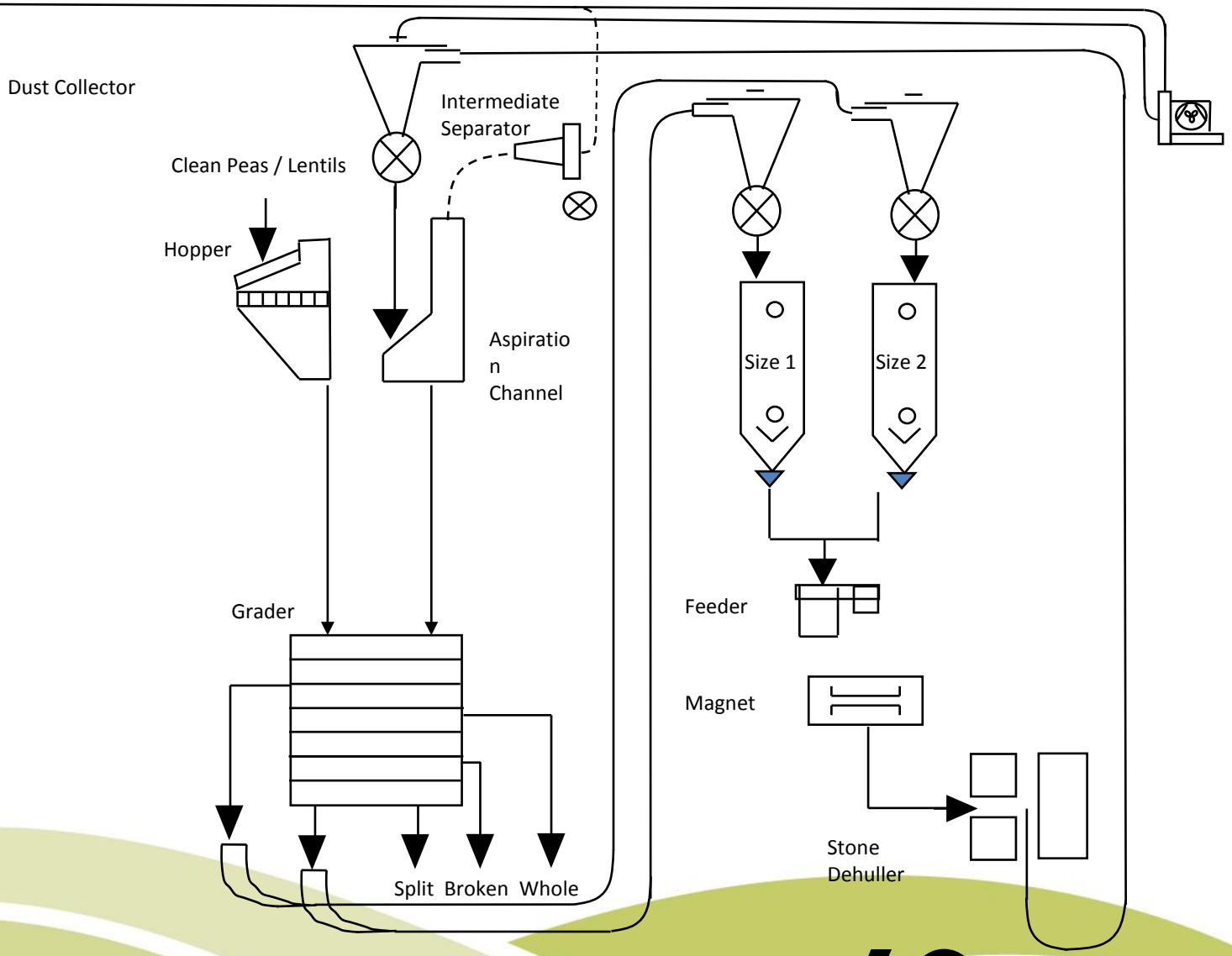
Roller Mill (RM)

Pilot dehulling of pulses

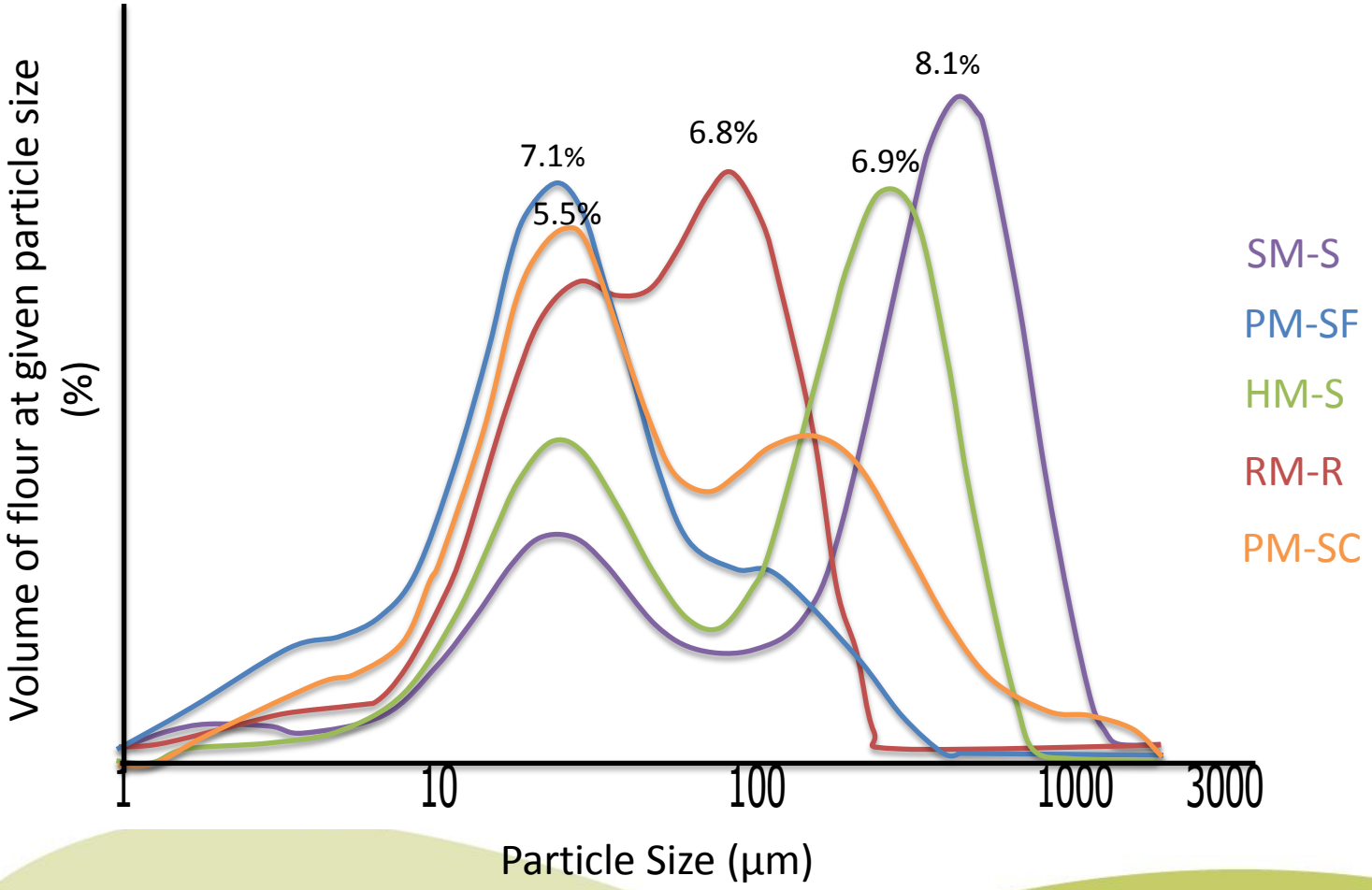
Grader

Dehulling

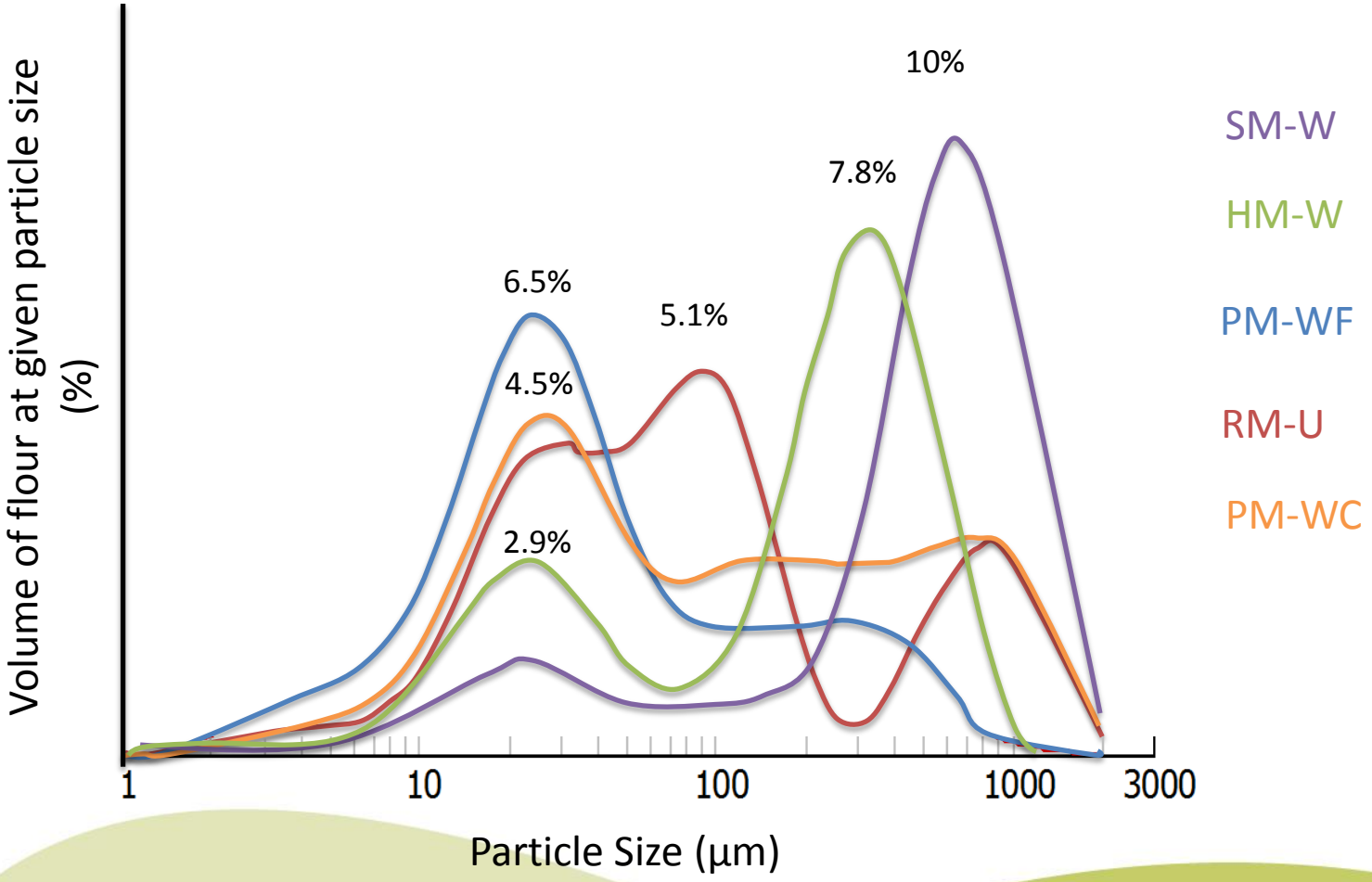
Process flow diagram – dehulling



Physical Properties- PSD



Physical Properties- PSD



Physical Properties- Summary

- Particle size affected by milling conditions
- Flour colour varies with flour particle size

Physical flour differences can affect end product quality

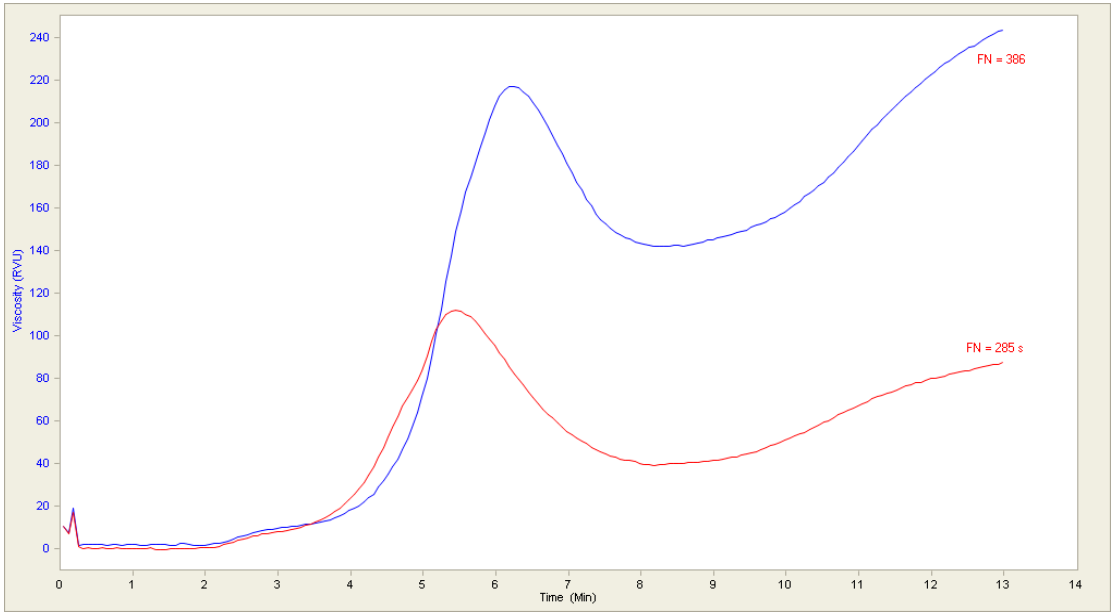
Compositional properties- Summary

Whole and split seeds greatest effect on composition

Important to consider for nutrition labeling

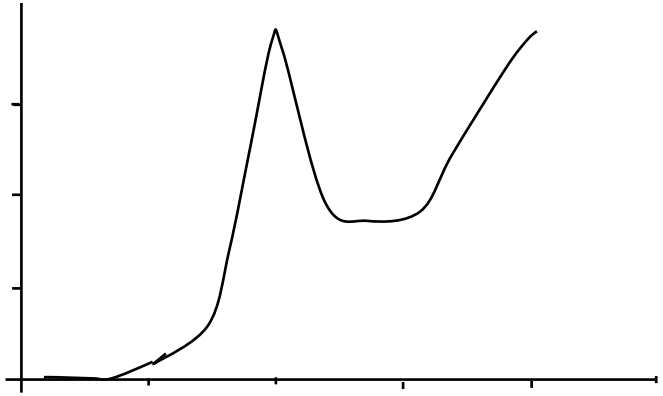
Functional properties of various field crops

RVA – Pasting curve for high and low falling number wheat flour



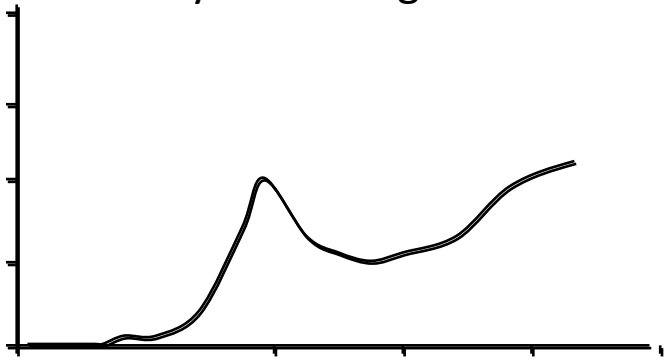
Improvement of RVA – Pasting profile adding barley

RVA – Pasting curve for HB flour



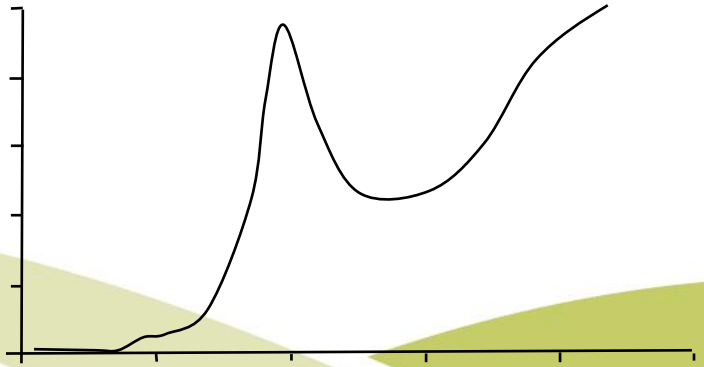
HB 100%

RVA –for a very low falling no. wheat flour



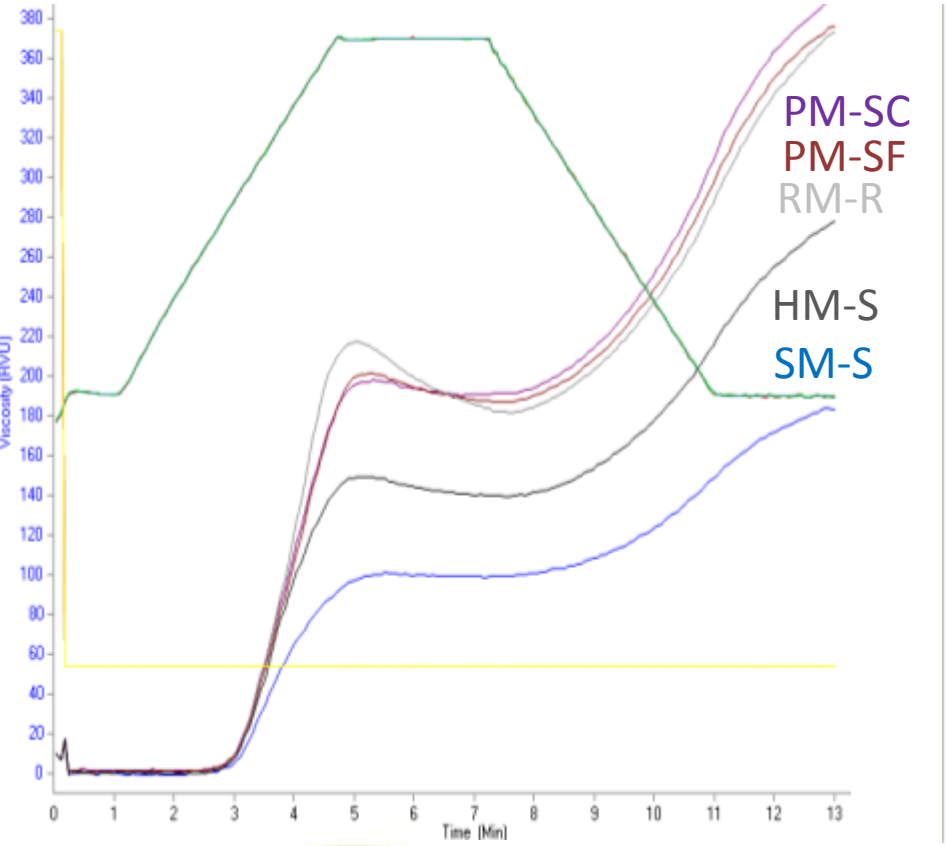
Wheat Flour 100%(AC Superb)

RVA –for a blend of HB and wheat flour

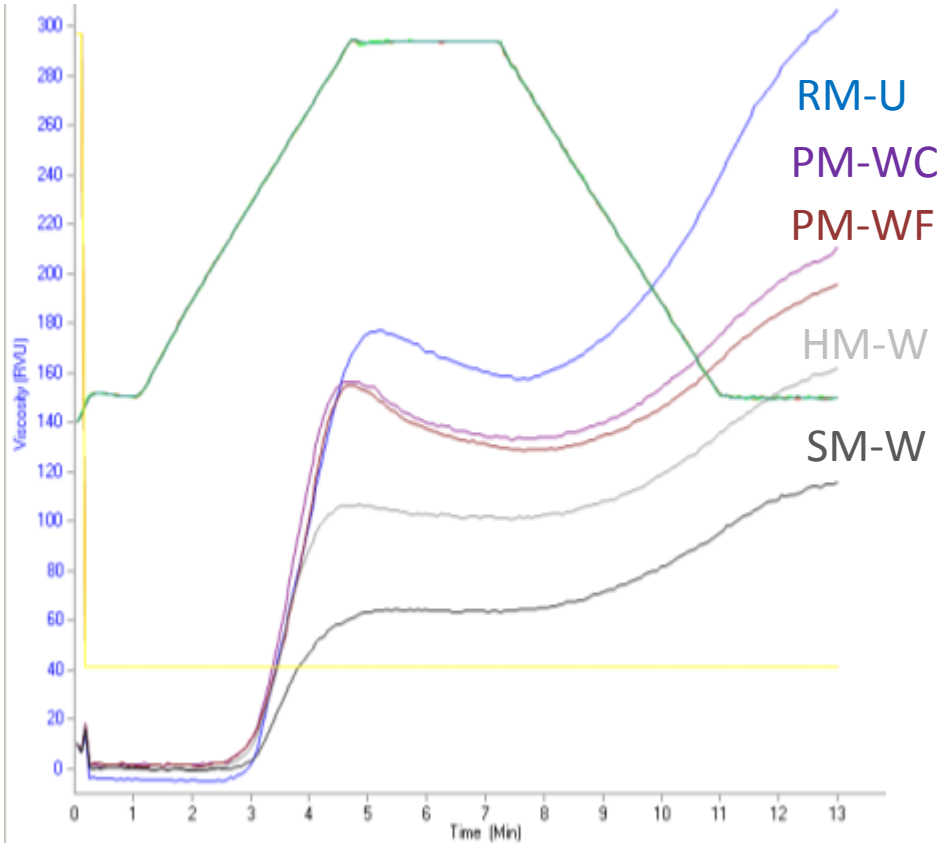


HB 50% (Millhouse) + Wheat Flour 50% (AC Superb)

Functional Properties- RVA



Split yellow pea flours



Whole yellow pea flours

Functional Properties Summary

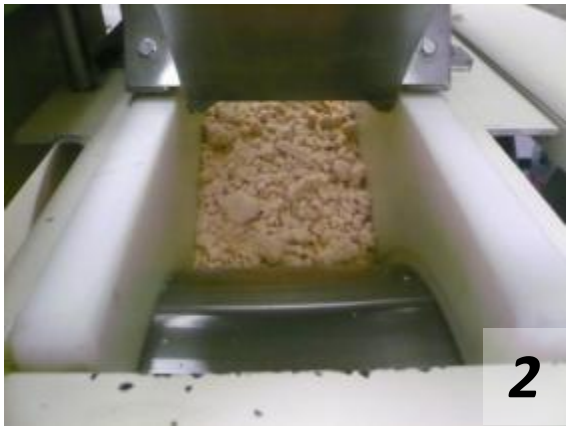
Functional properties affected by physical and compositional properties

- Fibre, protein, starch
- Average particle size
- Particle size distribution

End Product Evaluation

Direct Expansion

Asian Noodles



Batters

Increased cook yield
Increased batter pick-up
Lower oil absorption
Crispier and more golden colour
Improved freeze-thaw stress

Manitoba Food Development Centre ACIDF Project

Pasta

Need to address surface texture, cooking yield and cooking time.

Common Flour Grades

Flour Application
Strong Bakers
Large Bakers
Healthy Flour
Variety of noodles, breads & all purpose
Cake & Cookie Flour

Approximate average price of various field crops

Approximate average SK Price. Nov. 26/12	
Field Crop	Price per MT, $
Yellow peas	315.00
Lentils (Laird)	470.00
Navy beans	725.00
Food barley	275.00
FLA x	557.00
Wheat	302.50

Cost of flour per tonne calculations & projected selling prices per tonne

Wheat Type	WG WHEAT F	WG BARLEY	W G FLAX	W NAVY BEA	WG BUCKWHE
Cost per Tonne	700	365	800	352	660
% Foreign Material	1	1	1.5	1	0.5
% Raw Moisture	13	12	12	12	12
% Extraction	100	100	100	100	65
% Flour Ash Content	1.6	2.2	3	3	2.5
% Standard Ash	0.5	0.5	0.5	0.5	0.5
% Ash Corr. Factor	0	0	0	0	0
% Ash Corrected Ext	100	100	100	100	65
Raw Wheat Kgs	1000	1000	1000	1000	1000
Less For. Material	10	10	15	10	5
Clean Wheat	990	990	985	990	995
Optimum Mill Moist	16	12	12	12	12
Water Added	35.35	0	0	0	0
Clean Temp. Wheat	1025.35	990	985	990	995
Flour Yield	1025.35	990	985	990	646.75
Milling Loss 1.5%	15.38	14.85	14.77	14.85	14.92
Net Flour Yield	1009.97	975.15	970.22	975.15	631.82
Foreign Material	10	10	15	10	5
Gross By-Products	10	10	15	10	338.32
By-Products Value/To	100	100	100	100	100
Value of By-Products	1	1	1.5	1	33.83
Cost of Flour/Tonne of Wheat Ground	699	364	798.5	351	626.16
Cost of Flour/Tonne	681.71	367.67	810.65	354.54	968.17
Processing Costs/Ton	852.14	459.59	1013.32	443.18	1210.21
Price of Flour/Tonne	852.14	459.59	1013.32	[illegible]	1210.21

EXAMPL 1 PRODUCT NAME...FUNCTIONAL FLOUR 1

WHEAT/ FLOUR	PERCENT	COST/	LOW	HIGH	REST.$/	WHEAT/FLOUR
						Min. Max.
WHOLE WHEAT	65.00	852.14				65
WHITE NAVY	22.50	443.18		459.60		
WHOLE BARL EY	7.29	459.60	443.18	823.28		
GROUND FLA x	5.22	1013.00	467.80			
TOTAL WEIGHT 100.000 $739.95 PER TONNE						

EXAMPL 1 PRODUCT NAME...FUNCTIONAL FLOUR 1
Quality Report

NUM	9RESTRICTION	Unit	MINIMUM	ACTUAL	MAXIMUM	COST
1	CALORIES	kcal				
2	PROTEIN	%	13.00		20.00	
3	FAT	%				
4	CARBOHYDRATES	%				
5	DIETARY FIBER	%	15.00			
6	SOLUBLE FIBER	%	3.000			
7	GLYCEMIC INDEX	%			50.00	
8	OMEGA-3	%	1.2000			

EXAMPL 1 PRODUCT NAME...FUNCTIONAL FLOUR 1
Quality Report

NUM	9RESTRICTION	Unit	MINIMUM	ACTUAL	MAXIMUM	COST
1	CALORIES	kcal		293.71		
2	PROTEIN	%	13.00	16.18	20.00	
3	FAT	%		3.4712		
4	CARBOHYDRATES	%		58.66		
5	DIETARY FIBER	%	15.00	15.45		
6	SOLUBLE FIBER	%	3.000	3.000		
7	GLYCEMIC INDEX	%		46.24	50.00	
8	OMEGA-3	%	1.2000	1.2000		

EXAMPL 2 PRODUCT NAME...FUNCTIONAL FLOUR 2

WHEAT/ FLOUR	PERCENT	COST/	LOW	HIGH	REST.$/	WHEAT/FLOUR
						Min. Max.
WHOLE WHEAT	65.00	852.14				65
WHOLE BARL EY	27.30	459.60				
GROUND FLA x	7.70	1013.00	459.60			
TOTAL WEIGHT 100.000 $757.39 PER TONNE						

EXAMPL 1 PRODUCT NAME...FUNCTIONAL FLOUR 2
Quality Report

NUM	9RESTRICTION	Unit	MINIMUM	ACTUAL	MAXIMUM	COST
1	CALORIES	kcal				
2	PROTEIN	%	13.00		20.00	
3	FAT	%				
4	CARBOHYDRATES	%				
5	DIETARY FIBER	%	15.00			
6	SOLUBLE FIBER	%	3.000			
7	GLYCEMIC INDEX	%			50.00	
8	OMEGA-3	%	1.2000			

EXAMPL 1 PRODUCT NAME...FUNCTIONAL FLOUR 2
Quality Report

NUM	9RESTRICTION	Unit	MINIMUM	ACTUAL	MAXIMUM	COST
1	CALORIES	kcal		349.19		
2	PROTEIN	%	13.00	14.34	20.00	
3	FAT	%		4.8093		
4	CARBOHYDRATES	%		69.82		
5	DIETARY FIBER	%	15.00	15.00		
6	SOLUBLE FIBER	%	3.000	3.9495		
7	GLYCEMIC INDEX	%		43.64	50.00	
8	OMEGA-3	%	1.2000	1.7710		

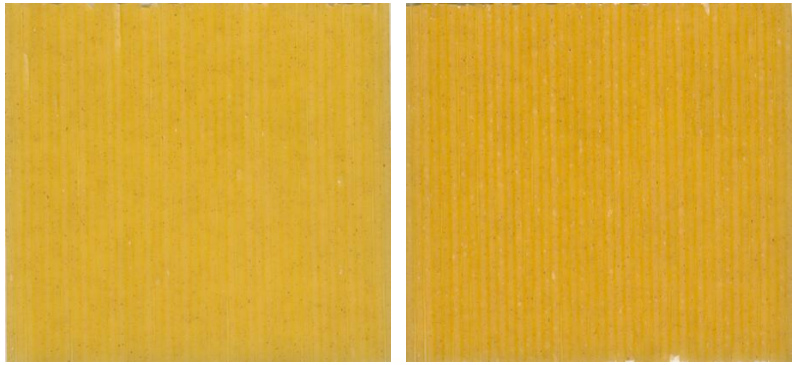
Available barley products

Potential barley products

Pan Bread

Tortilla

Pita Bread



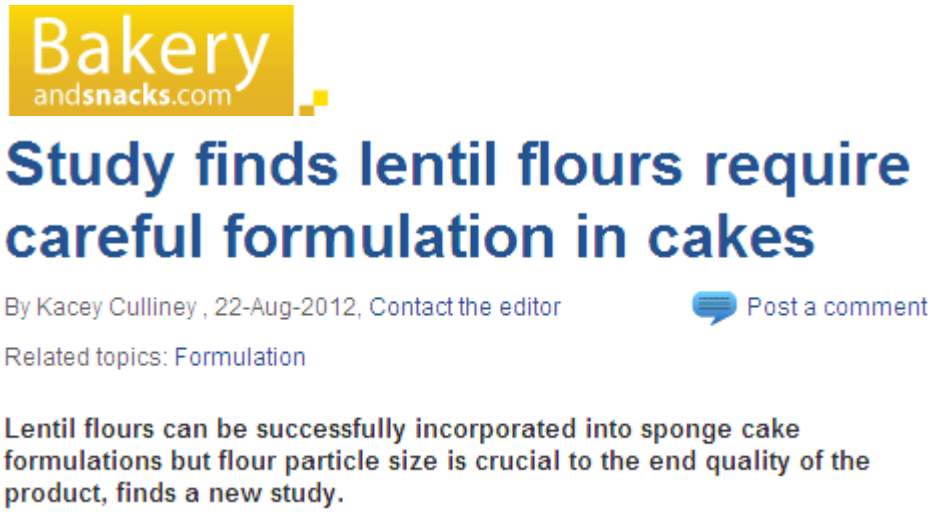
Pasta

Quality Conclusions

Not all flours are the same.

What flour specifications should be targeted?

Conclusions



Bakery andsnacks.com

Study finds lentil flours require careful formulation in cakes

By Kacey Culliney , 22-Aug-2012, Contact the editor Post a comment

Related topics: Formulation

Lentil flours can be successfully incorporated into sponge cake formulations but flour particle size is crucial to the end quality of the product, finds a new study.

End product quality is dependent on the specifications of the ingredient. It is important to make sure you are using the right ingredient for the right job.

Questions and Discussion related to pulse milling project

Webinar recording and handout available at:
www.pulsecanada.com and www.cigi.ca



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Agriculture and Agri-Food Canada

CSCA CANADIAN SPECIAL CROPS ASSOCIATION ASSOCIATION CANADIENNE DE CULTURES SPÉCIALES

Alberta Pulse Growers

SASKATCHEWAN pulse Growers

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- Pulse Canada
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  - Bakery
  - Noodles and Asian Products
  - Pasta and Extrusion
  - Pulse and Special Crops
  - Communications