Solutions to support dairy innovation with focus on consumer demands

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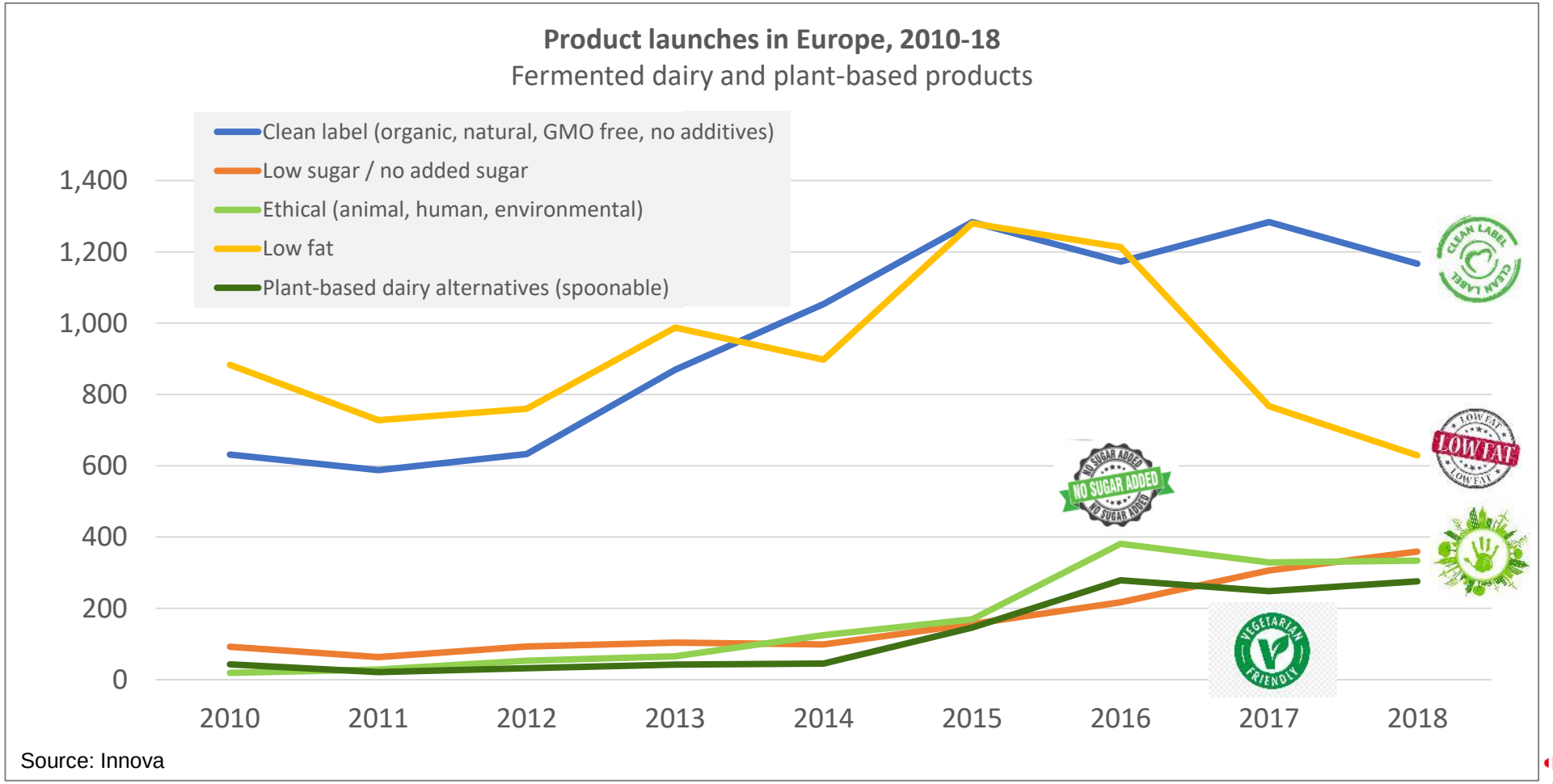
Agenda

Solutions to support dairy innovation with focus on consumer demands

- Trends in fresh fermented products
- Solutions to support targeted key trends
- Concept sample

Trends seen in Europe

Clean label, Sustainable/Ethical, Plant-based and Low sugar are currently some of the most prominent or growing trends in the fermented dairy and plant-based segment in Europe, as opposed to e.g. low fat



Source: Innova

Focus on the four selected key trends

Clean label

Consumers' focus on natural and fewer ingredients, minimally processed food, free from preservatives and additives, and GM-free

Search for transparency and authenticity

Sustainability

Consumers look to make more mindful food choices with focus on the environment and high ethical standards:

E.g. sustainably sourced ingredients, production processes with minimal carbon footprint, water and energy use, animal welfare, etc.

Sugar reduction

Sugar has taken over from fat and has become linked to obesity and diabetes.

Consumers therefore look for sugar-reduced food, but with acceptable taste and texture and no artificial sweeteners.

Plant-based

Plant-based food meets consumers' needs in terms of health, sustainability and an interest in novel taste experiences.

Plant-based products often positioned to replace animal based food products for same eating occasion.

Toolbox for fresh fermented products

Starter culture

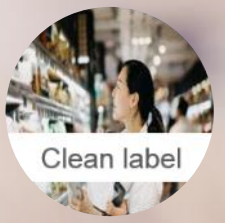
Texturants

Yogurt fruit preparation

Fermented base composition

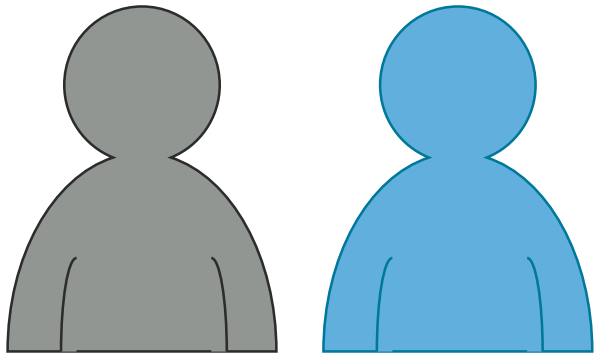
Process technology

Building on culture performance to deliver texture



1 in 2 consumers from UK, US and Australia:

"I consider a food or beverage product as being more natural if it has fewer ingredients on the ingredients list"

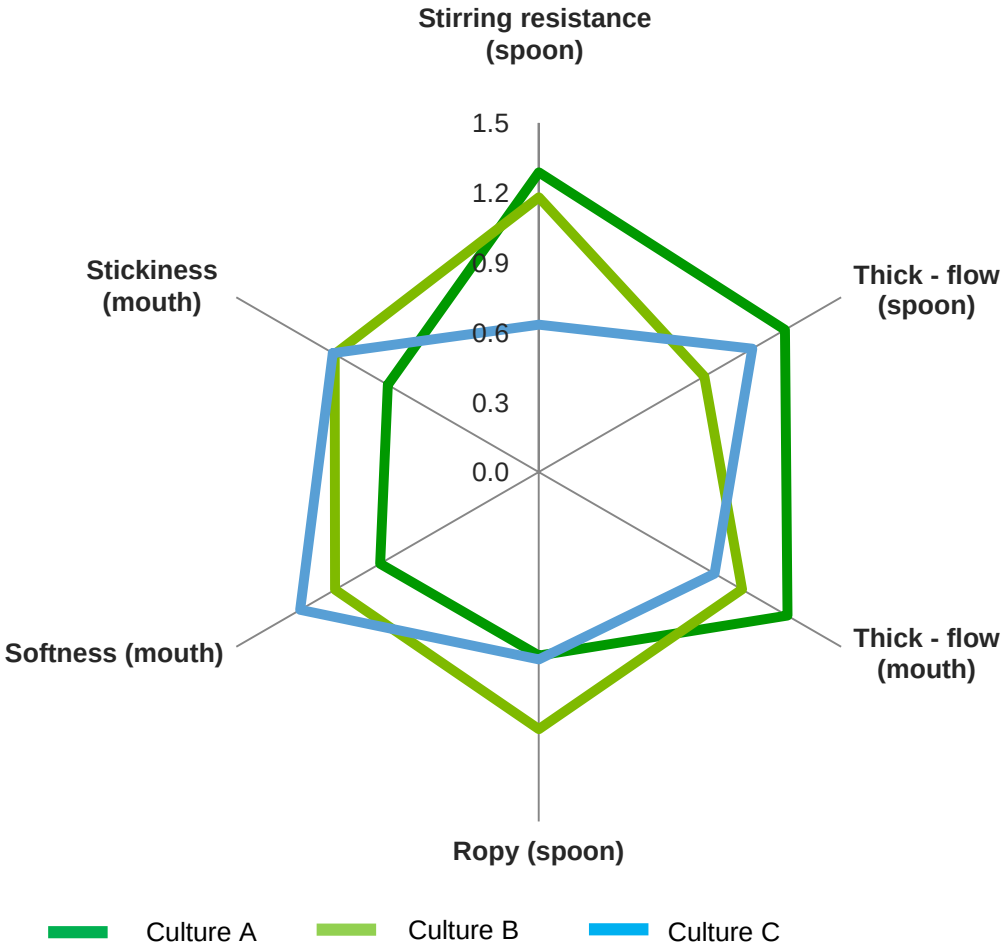


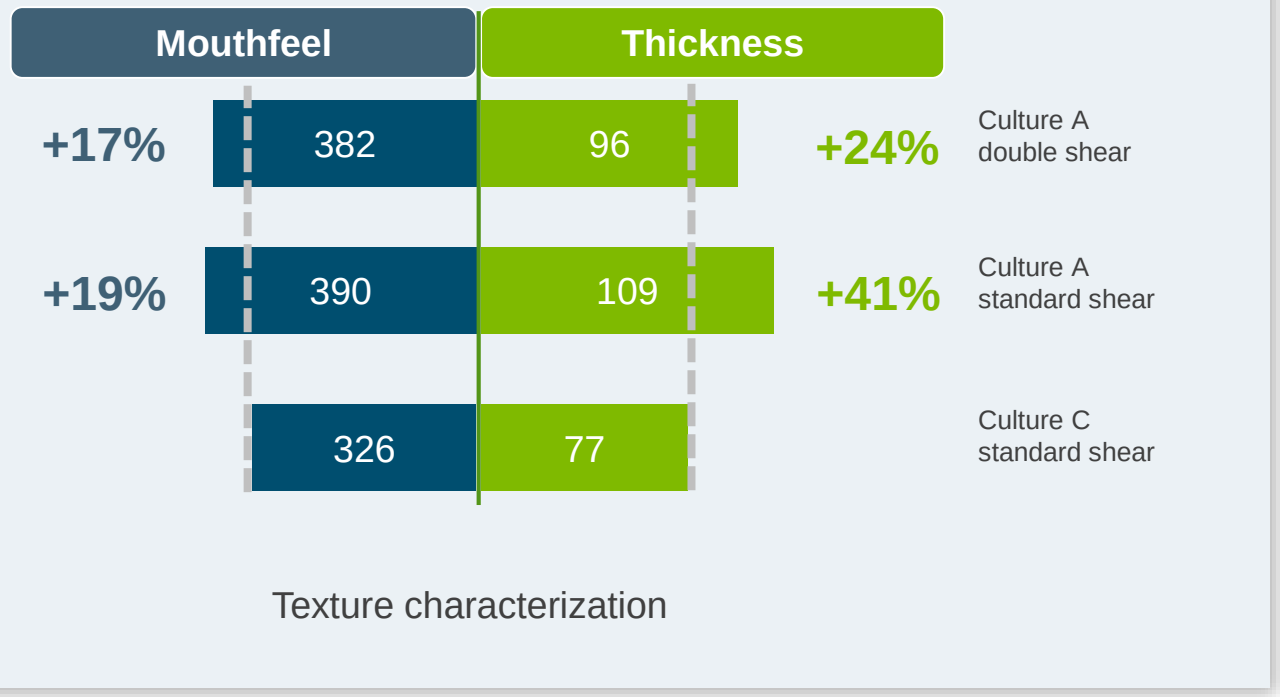
Source: Innova

Highly Texturizing Cultures

For simple, indulgent and cost-effective stirred yogurt

Modern cultures for thicker texture & superior mouthfeel with high shear resistance

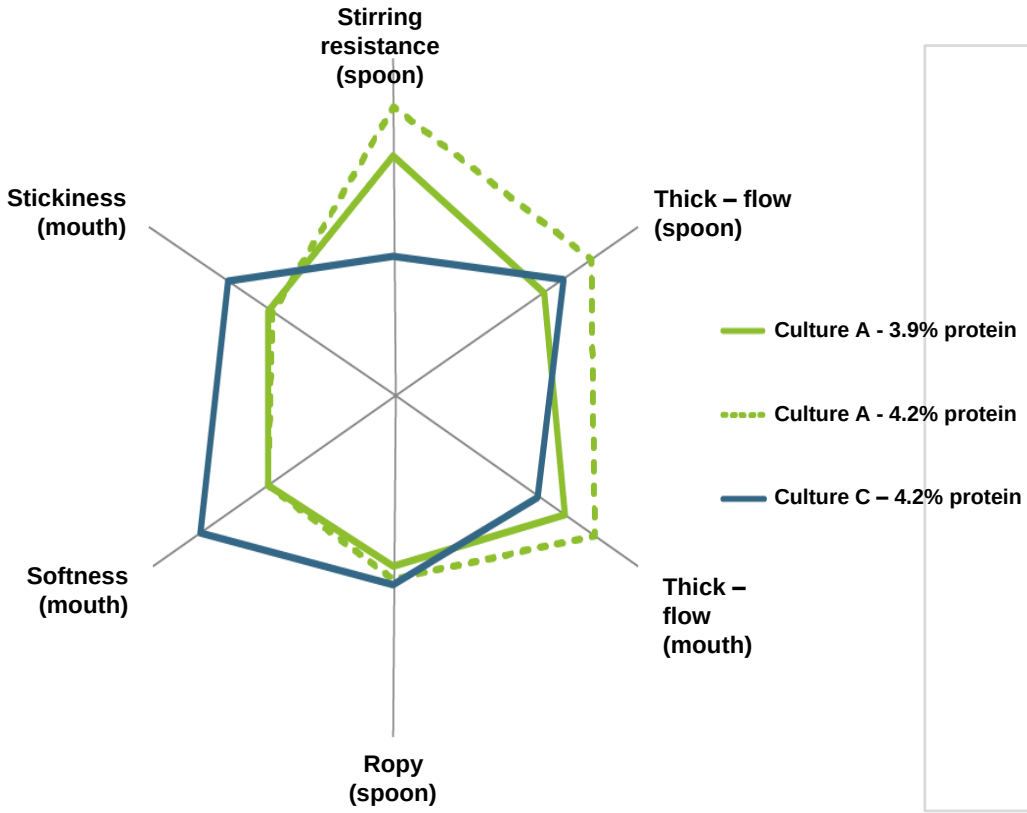




Use modern cultures with thicker texture to build value in yogurt

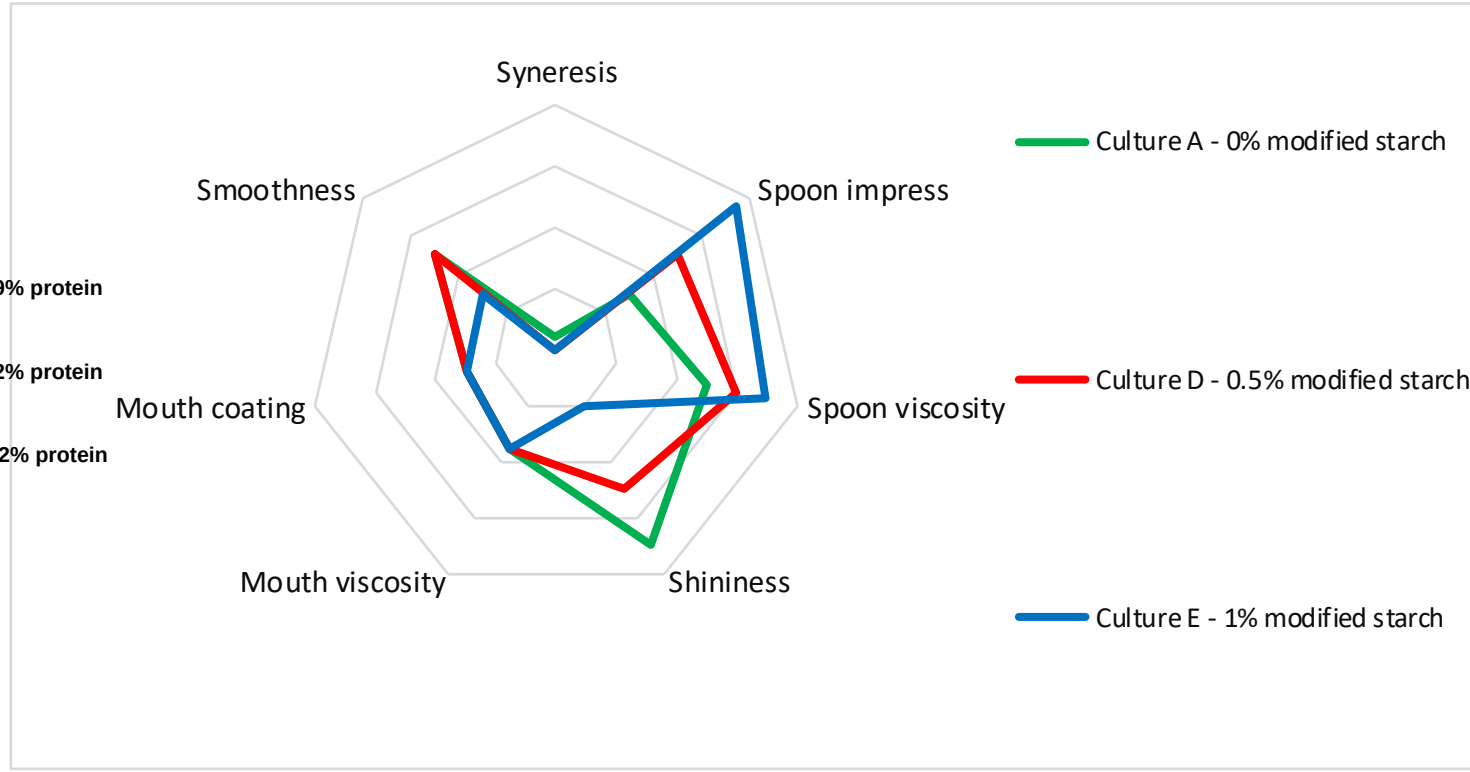
Protein reduction without losing texture

0.3% protein reduction = reduction of 2 €/100 kg yogurt



Yogurt with cleaner labelling

½-1% starch can be removed from the yogurt formulation without impact on mouth viscosity

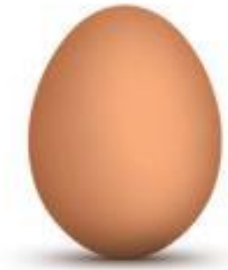


What if natural products came with a list of ingredients?

AN ALL-NATURAL BANANA

INGREDIENTS: WATER (75%), **SUGARS (12%)** (GLUCOSE (48%), FRUCTOSE (40%), SUCROSE (2%), MALTOSE (<1%)), STARCH (5%), **FIBRE (3%)** (E460, E461, E462, E464, E466, E467) **AMINO ACIDS** (GLUTAMIC ACID (19%), ASPARTIC ACID (16%), HISTIDINE (11%), LEUCINE (7%), LYSINE (5%), PHENYLALANINE (4%), ARGININE (4%), VALINE (4%), ALANINE (4%), SERINE (4%), GLYCINE (3%), THREONINE (3%), ISOLEUCINE (3%), PROLINE (3%), TRYPTOPHAN (1%), CYSTINE (1%), TYROSINE (1%), METHIONINE (1%)), **FATTY ACIDS (1%)** (PALMITIC ACID (30%), OMEGA-6 FATTY ACID: LINOLEIC ACID (14%), OMEGA-3 FATTY ACID: LINOLENIC ACID (8%), OLEIC ACID (7%), PALMITOLEIC ACID (3%), STEARIC ACID (2%), LAURIC ACID (1%), MYRISTIC ACID (1%), CAPRIC ACID (<1%)), ASH (<1%), PHYTOSTEROLS, E515, OXALIC ACID, E300, E306 (TOCOPHEROL), PHYLLOQUINONE, THIAMIN, **COLOURS** (YELLOW-ORANGE E101 (RIBOFLAVIN), YELLOW-BROWN E160a), **FLAVOURS** (ETHYL HEXANOATE, ETHYL BUTANOATE, 3-METHYLBUT-1-YL ETHANOATE, PENTYL ACETATE), E1510, NATURAL RIPENING AGENT (ETHENE GAS).

INGREDIENTS OF AN ALL-NATURAL EGG



INGREDIENTS: AQUA (75.8%), **AMINO ACIDS (12.6%)** (GLUTAMIC ACID (14%), ASPARTIC ACID (11%), VALINE (8%), ARGININE (8%), LEUCINE (8%), LYSINE (7%), SERINE (7%), PHENYLALANINE (6%), ALANINE (5%), ISOLEUCINE (5%), PROLINE (4%), TYROSINE (3%), THREONINE (3%), GLYCINE (3%), HISTIDINE (2%), METHIONINE (3%), CYSTINE (2%), TRYPTOPHAN (1%)); **FATTY ACIDS (9.9%)** (OCTADECENOIC ACID (45%), HEXADECANOIC ACID (32%), OCTADECANOIC ACID (12%), EICOSATETRAENOIC ACID (3%), EICOSANOIC ACID (2%), DODOSANOIC ACID (1%), TETRACOSANOIC ACID (1%), OCTANOIC ACID (<1%), DECANOIC ACID (<1%), DODECANOIC ACID (<1%), TETRADECANOIC ACID (<1%), PENTADECANOIC ACID (<1%), HEPTADECANOIC ACID (<1%), TETRADECENOIC ACID (<1%), HEXADECENOIC ACID (<1%), EICOSENOIC ACID (<1%), DOCOSENOIC ACID (<1%), OMEGA-6 FATTY ACID: OCTADECADIENOIC ACID (12%), OMEGA-3 FATTY ACID: OCTADECATRIENOIC ACID (<1%), EICOSAPENTAENOIC ACID (EPA) (<1%), OMEGA 3 FATTY ACID: DOCOSAHEXAENOIC ACID (DHA) (<1%)); **SUGARS (0.8%)** (GLUCOSE (30%), SUCROSE (15%), FRUCTOSE (15%), LACTOSE (15%), MALTOSE (15%), GALACTOSE (15%)); **COLOUR** (E160c, E160a), E306, E101; **FLAVOURS** (PHENYLACETALDEHYDE, DODECA-2-ENAL, HEPTA-2-ENAL, HEXADECANAL, OCTADECANAL, PENTAN-2-ONE, BUTAN-2-ONE, ACETALDEHYDE, FORMALDEHYDE, ACETONE); SHELL (E170), ALSO CONTAINS BENZENE & BENZENE DERIVATIVES, ESTERS, FURANS, SULFUR CONTAINING COMPOUNDS AND TERPENES.

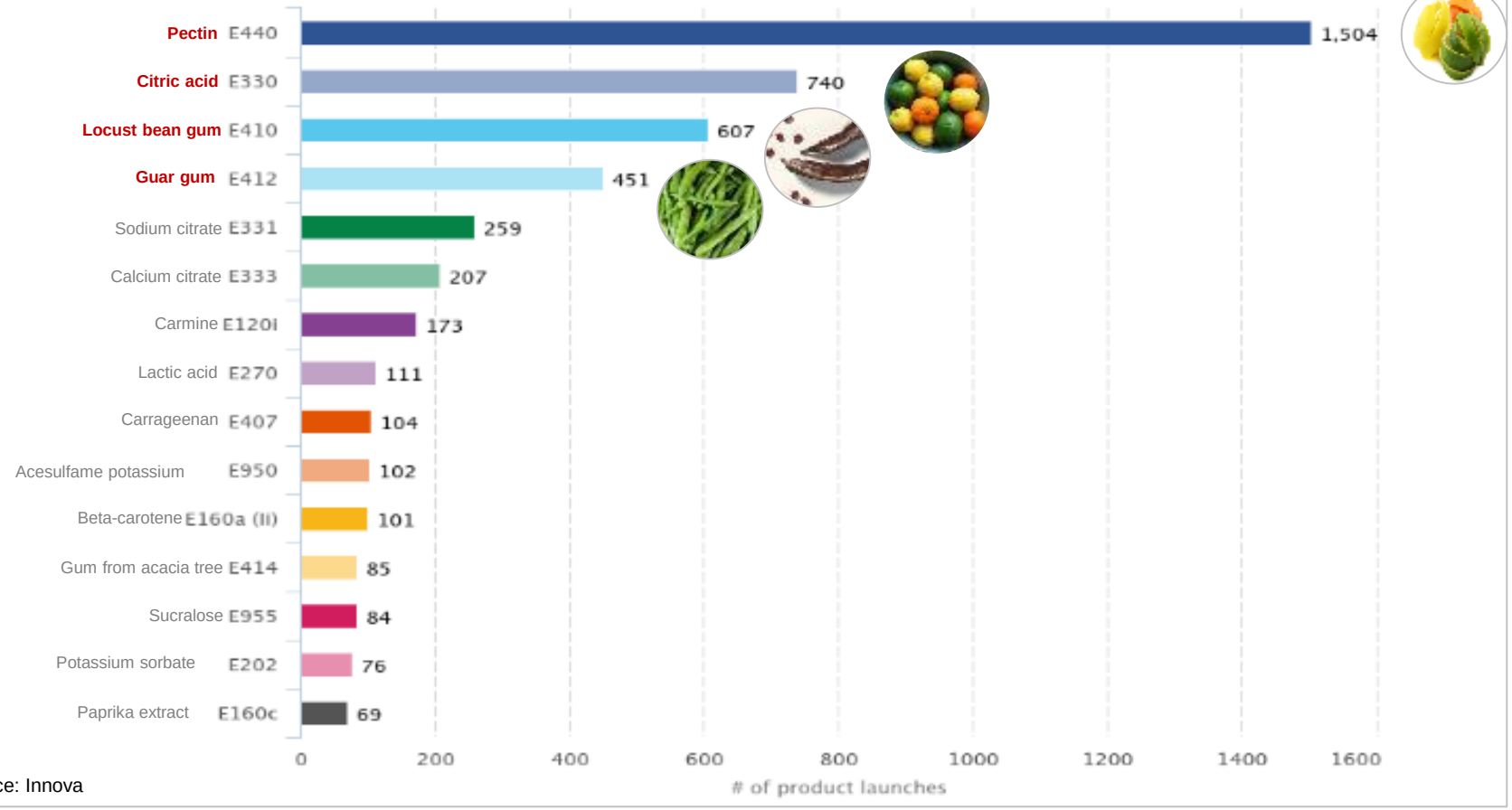
INGREDIENTS OF ALL-NATURAL BLUEBERRIES

INGREDIENTS: AQUA (84%), **SUGARS (10%)** (FRUCTOSE (48%), GLUCOSE (40%), SUCROSE (2%)), **FIBRE (2.4%)** (E460, E461, E462, E464, E466, E467) **AMINO ACIDS** (GLUTAMIC ACID (23%), ASPARTIC ACID (18%), LEUCINE (17%), ARGININE (8%), ALANINE (4%), VALINE (4%), GLYCINE (4%), PROLINE (4%), ISOLEUCINE (3%), SERINE (3%), THREONINE (3%), PHENYLALANINE (2%), LYSINE (2%), METHIONINE (2%), TYROSINE (1%), HISTIDINE (1%), CYSTINE (1%), TRYPTOPHAN (<1%)), **FATTY ACIDS (<1%)** (OMEGA-6 FATTY ACID: LINOLEIC ACID (30%), OMEGA-3 FATTY ACID: LINOLENIC ACID (19%), OLEIC ACID (18%), PALMITIC ACID (6%), STEARIC ACID (2%), PALMITOLEIC ACID (<1%)), ASH (<1%), PHYTOSTEROLS, OXALIC ACID, E300, E306 (TOCOPHEROL), THIAMIN, **COLOURS** (E163a, E163b, E163e, E163f, E160a) **FLAVOURS** (ETHYL ETHANOATE, 3-METHYL BUTYRALDEHYDE, 2-METHYL BUTYRALDEHYDE, PENTANAL, METHYLBUTYRATE, OCTENE, HEXANAL, STYRENE, NONANE, NON-1-ENE, LINALOOL, CITRAL, BENZALDEHYDE, BUTYLATED HYDROXYTOLUENE (E321)), METHYLPARABEN, E1510, E300, E440, E421 and **FRESH AIR** (E941, E948, E290).

Source: http://io9.com/what-if-natural-products-came-with-a-list-of-ingredient-1503320184

Clean label yogurt launches: pectin, citric acid, LBG and guar gum are the top 4 ingredients used

Top 15 E-numbers used in yogurt and drinking yogurt launches with clean label positioning, Europe:



Source: Innova

Potential clean label ingredients

- Pectin
- LBG
- Clean label starch
- Protein
- Fibers
- Agar

Considerations:

Legislation
- Yogurt
- Fresh fermented products

Processing technology

Consumer demands

Clean label solutions for fermented products

GRINDSTED® Yo-Tex 1000 Series

- GRINDSTED® Yo-Tex 920
- GRINDSTED® Yo-Tex 965
- GRINDSTED® Yo-Tex 1010
- GRINDSTED® Yo-Tex 1040
- GRINDSTED® Yo-Tex 1045
- GRINDSTED® Yo-Tex 1050
- GRINDSTED® Yo-Tex 1060
- GRINDSTED® Yo-Tex 1065
- GRINDSTED® Pectin AMD
- GRINDSTED® Pectin SY

GRINDSTED® PECTIN AMD & SY Series

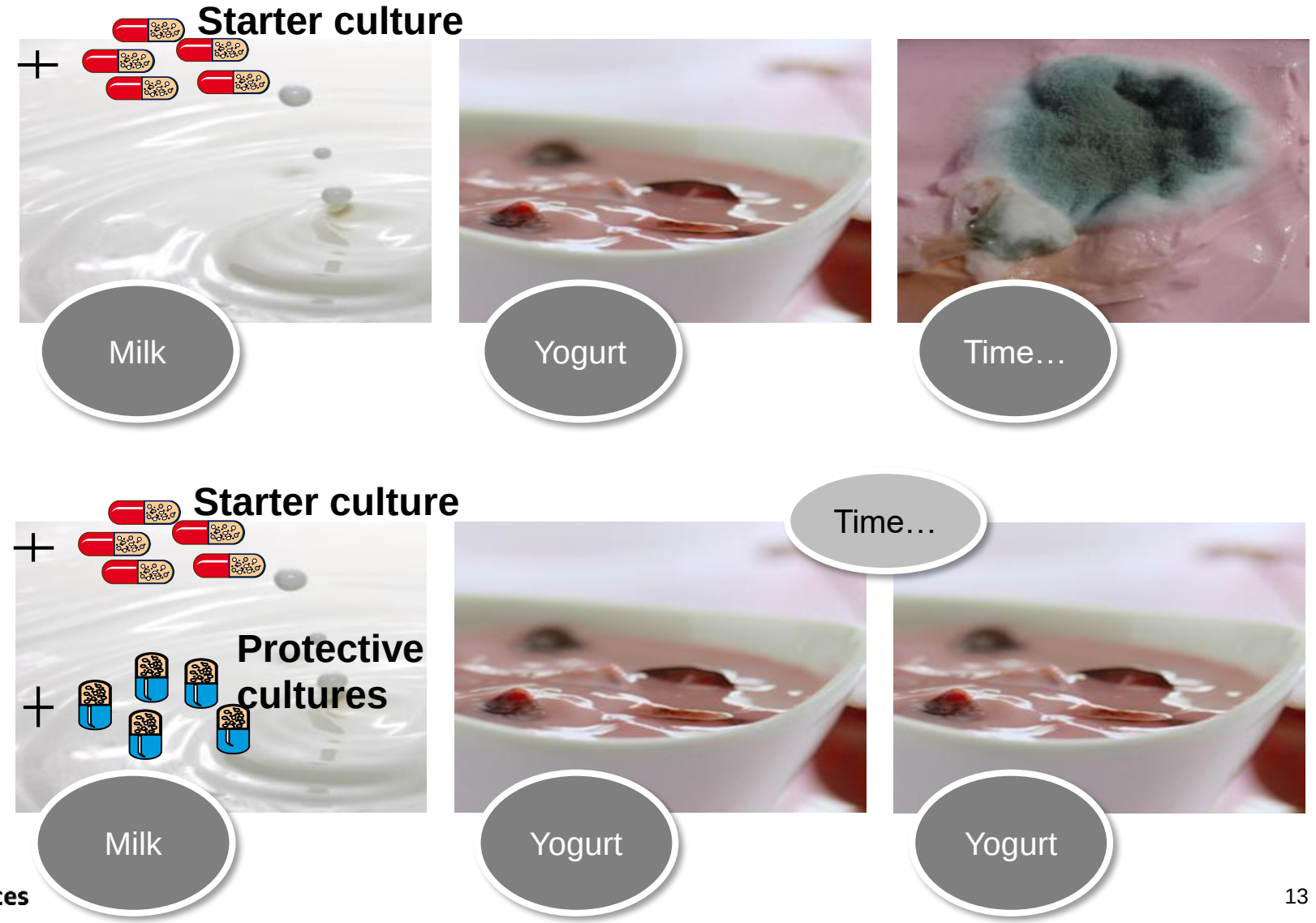
® & CHOOZIT® Cultures

GRINDSTED® PLANT-TEX YO 1000 Series

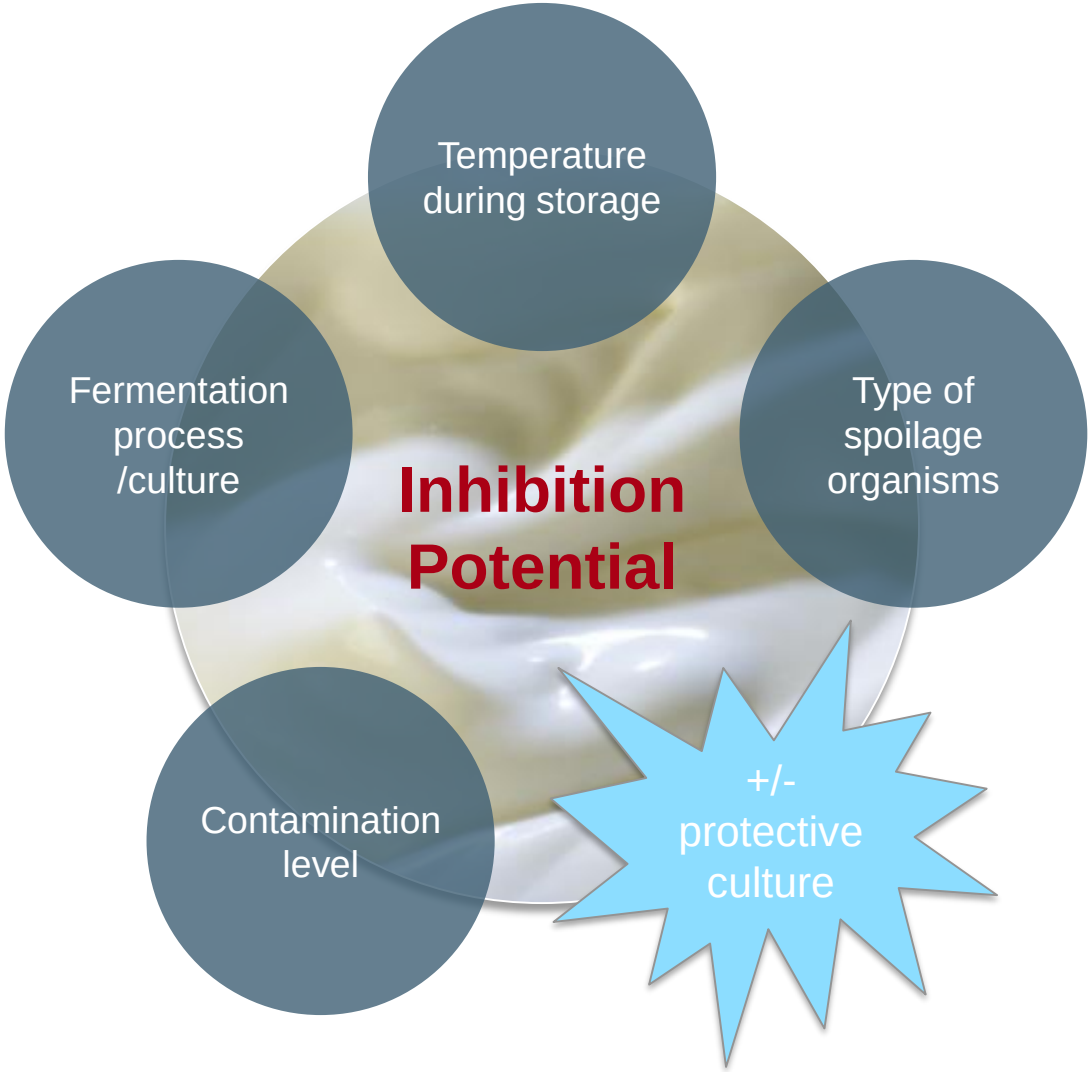
- GRINDSTED® PLANT-TEX YO 1000
- GRINDSTED® PLANT-TEX YO 1005
- GRINDSTED® PLANT-TEX YO 1010
- GRINDSTED® PLANT-TEX YO 1015
- GRINDSTED® PLANT-TEX YO 1040
- GRINDSTED® PLANT-TEX YO 1045
- GRINDSTED® Gellan VEG 200
- GRINDSTED® Pectin AMD
- GRINDSTED® Pectin SY

GRINDSTED® PECTIN SY Series

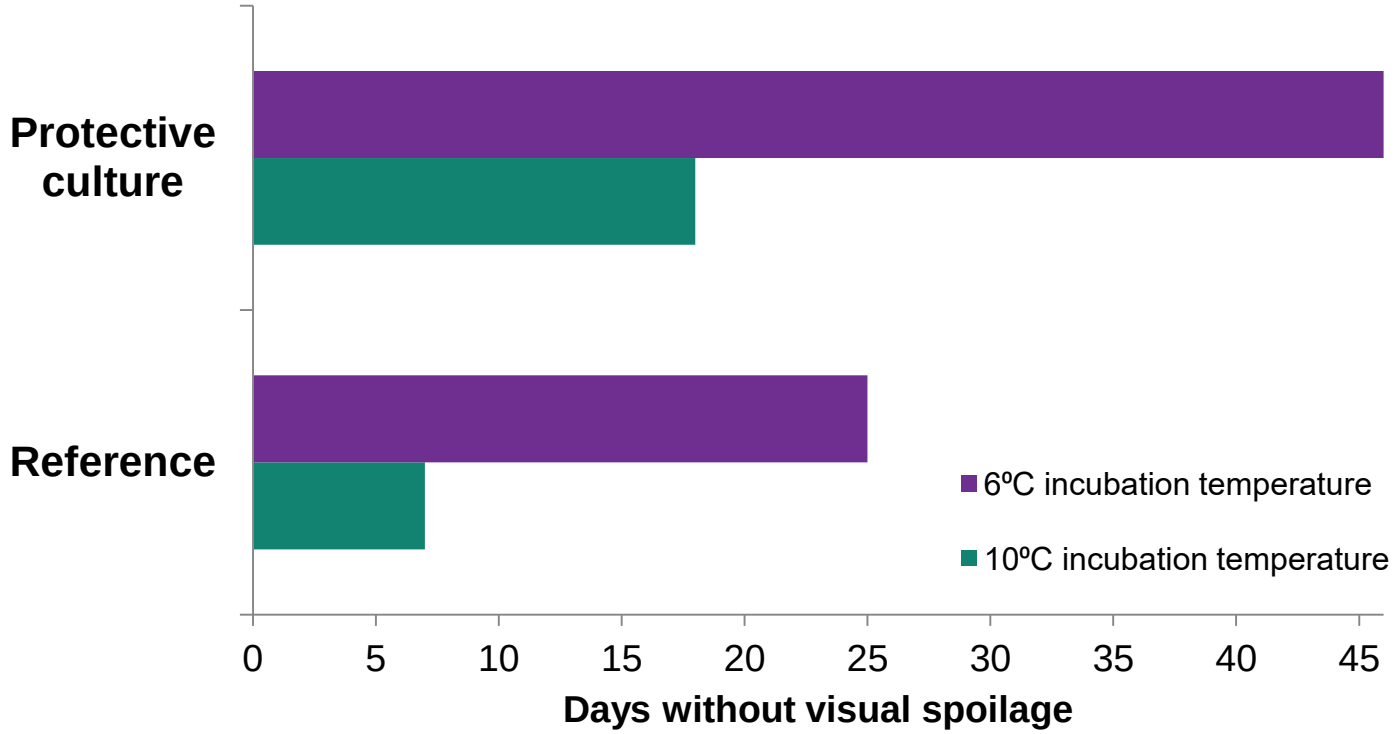
Use of protective cultures to maintain product freshness



Natural inhibition potential



(Extra) product stability even during temperature abuse



Application: 3% fat yogurt
Mold inoculation level: 10 spores/ml
Test conditions: Stored at 6ºC or 10ºC for 46 days and visually evaluated
10 DCU HOLDBAC™ YM-C was tested

Sugar reduction in yogurt is a challenging task


Sugar reduction

Sugar is more than just sweetness in yogurt:

- Sweetness
- Balances sourness (acidity)
- Flavor profile
- Adds body in the form of solids

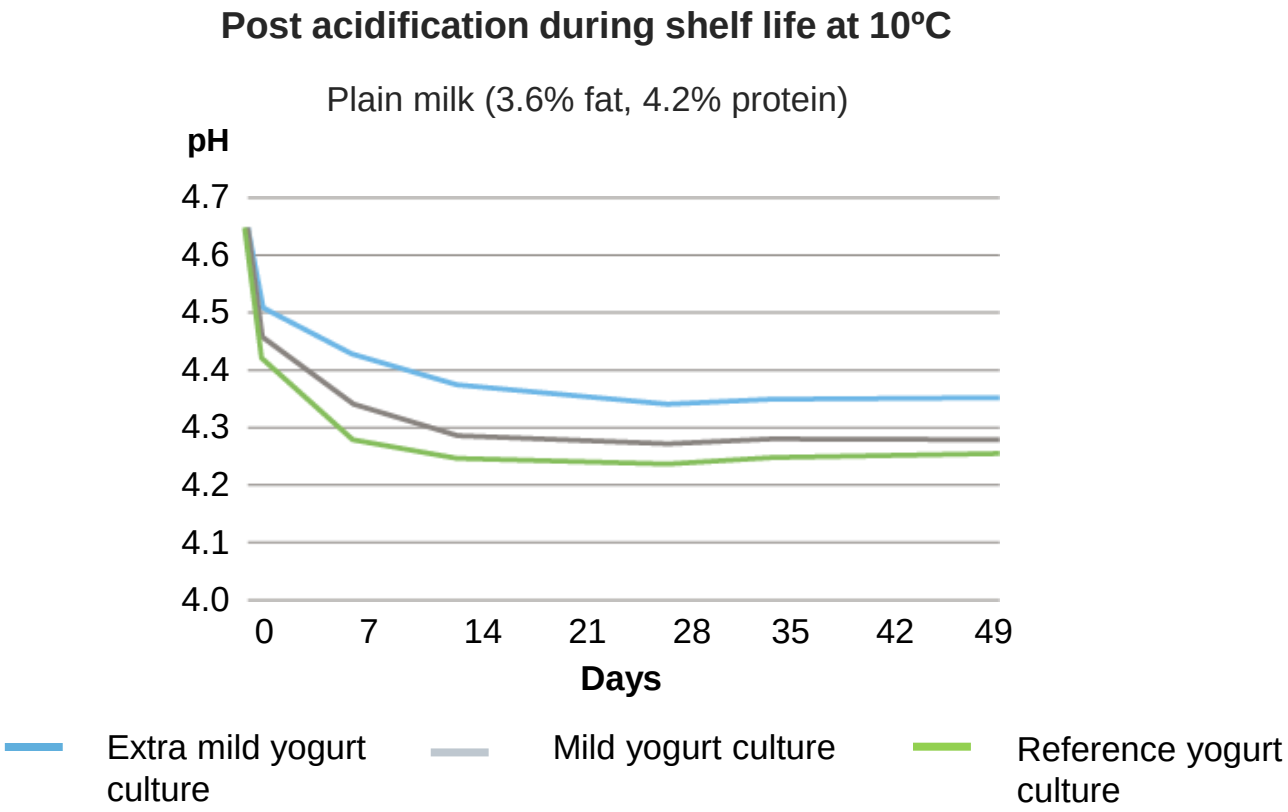
Sugar reduction requires:

- Sweetness compensation
- Dry matter compensation
- Flavor adjustments
- Yogurt fruit adjustments

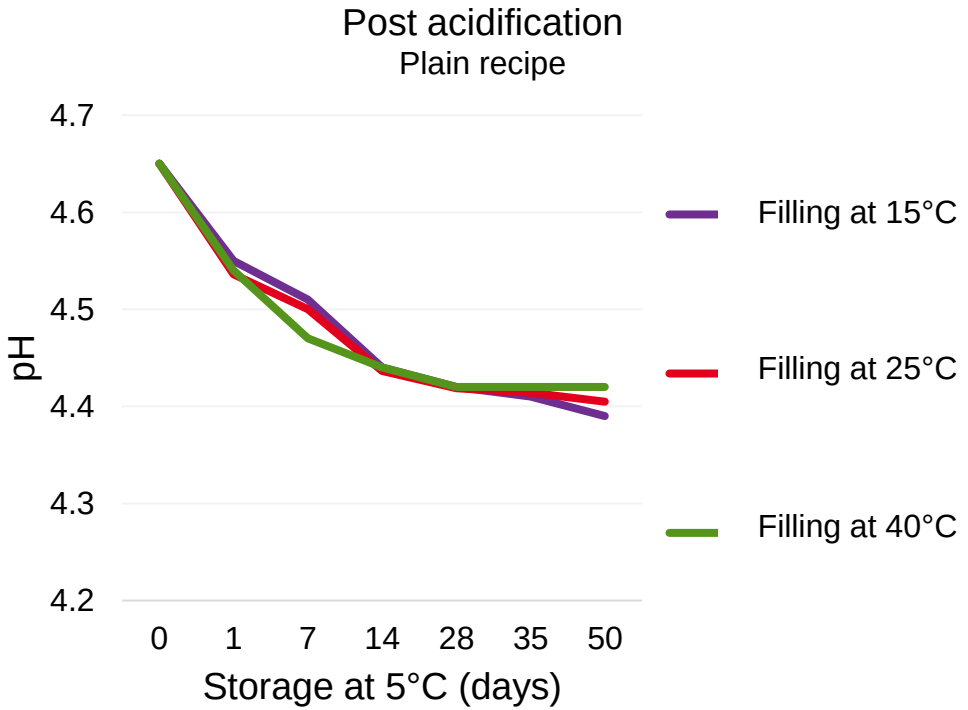
DUPONT Danisco

Yogurt culture providing guaranteed extra mildness

Extra mild yogurt culture enabling sugar reduction without losing sweetness



Extra mild yogurt culture allows texture compensation at high filling temperatures



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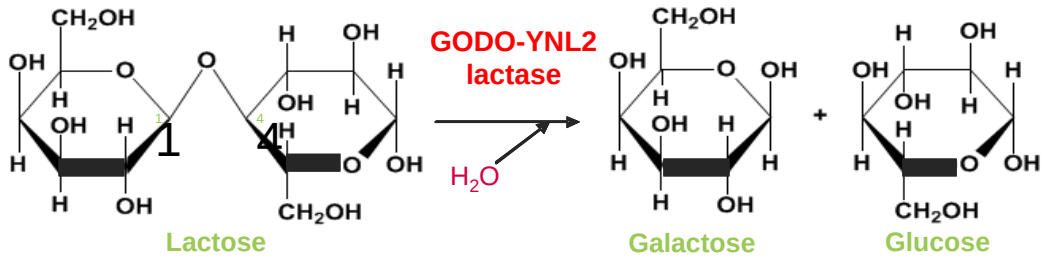
Optimization of sugar addition in yogurt using lactase

Lactose hydrolysis releases additional sweetness

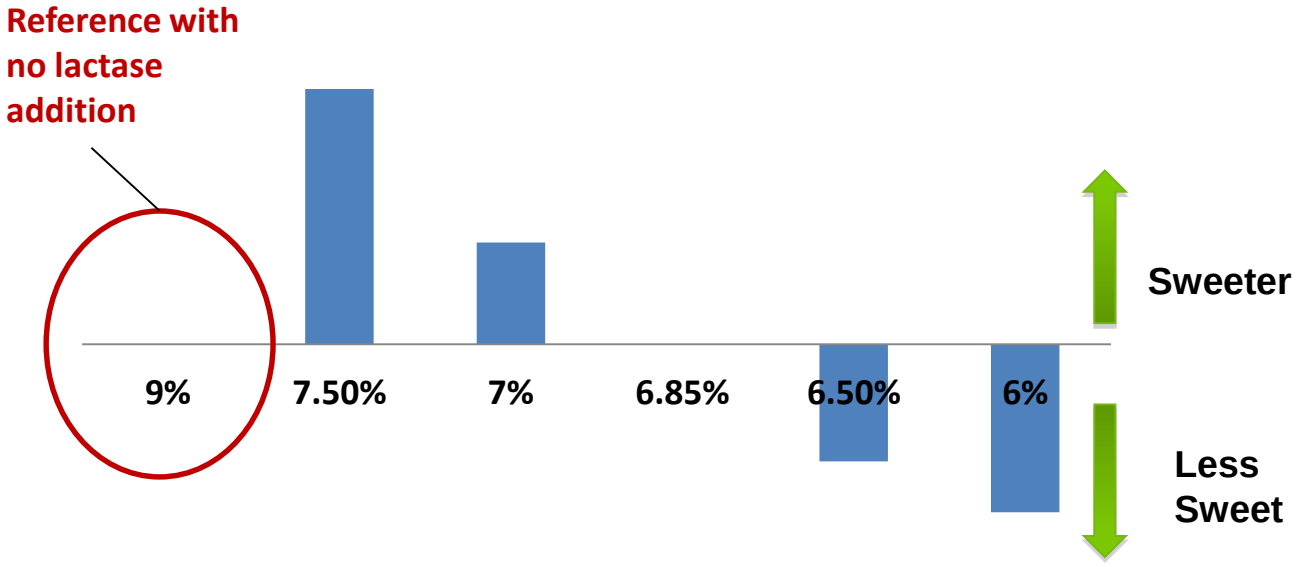


Sweetness index	16	33	74

Sweetness impact by lactose hydrolysation	% sugar (sucrose)	Calculated sweetness	Base % lactose
Milk	-	0.8	4.7
Lactose-free milk	-	2.5	4.7

* Relative sweetness (http://biology.clc.uc.edu/courses/bio104/carbohydrates.htm):

Sensory evaluation confirming sugar reduction in yogurt

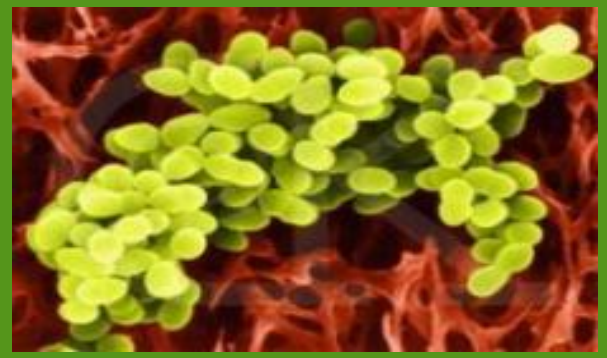


Relative sweetness profiling ran by sensory panel of 8 persons, double triangle test against reference product at 9% sucrose in white mass

Special cultures for fermentation of plant-based matrix

Basis for development is broad culture expertise in formulation for fermentation of plant matrix and wide strain collection for screening

A large diversity of microrganisms



Strain selection & development of special culture formulations adapted to a variety of plant-based fermented food & beverage products

Nutrients available for fermentation of plant matrix

Why standard dairy cultures are not the optimal solution

- For lactic acid bacteria, carbohydrates & proteins are required. These impact the ability of the strain to grow
- Carbohydrate composition of plant-based raw materials is complex, diverse and different from that of milk

	Milk	Soy	Oat	Rice	Coconut	Almond
Lactose	100%					
Maltose			100%	97%		
Sucrose		38%		3%	42%	85%
Glucose	Trace	19%	Trace		33%	
Galactose	Trace					
Fructose		43%			25%	
Raffinose						5%
Stachyose		Trace			Trace	Trace
Melezitose						Trace
Melibiose		Trace				

Comparison of carbohydrate composition in different plant based raw materials versus milk

* Published patent on 24/08/2017 : “Manufacture of lactic-acid fermented batter”, WO2017/140796 A1.
* Published patent on 19/10/2017 : “Manufacture of cereal-based lactic acid fermented product”, WO2017178514 A1

Market requirement to cultures plant-based fermentations

- Fermentation capability for a broad range of plant-based raw material
- Certified for safety and compliance with demand for:
  - allergen free
  - dairy & lactose free
  - soy free
  - GMO free
  - Kosher & halal certified
- Comply with organic and vegan requirements
- Easy to use in production

DuPont offering for fermented plant-based products

Danisco® VEGE Culture	Nut matrix (coconut, almond, cashew, ….)	Cereal matrix (oat, rice,….)	Fruit & vegetable matrix (apple, carrot, pumpkin,..)	Bean matrix (Pea, Chickpea, Lentils, …)	Soy matrix	Other fermented Foods matrix
Danisco® VEGE ST LYO series	●	●		●	●	●
Danisco® VEGE 030 LYO series	●	●		●	●	●
Danisco® VEGE 050 LYO series	●	●	●	●	●	●
Danisco® VEGE 020 LYO series Danisco® VEGE 040 LYO series Danisco® VEGE 060 LYO series	●	●			●	
Danisco® VEGE 010 LYO series Danisco® VEGE 090 LYO series			●			●
Danisco® VEGE 080 LYO series		●				●
Danisco® VEGE C-100 LYO series	X	●	X	●	X	X
HOWARU® VEGE BIFIDO LYO HOWARU® VEGE DOPHILUS LYO	X	X	X	X	X	X
HOLDBAC® VEGE YM FRO HOLDBAC® LC LYO	X	X	X	X	X	X

X to be use in addition to Danisco VEGE

● First choice recommendation

DUPONT Danisco

DuPont solutions for use in fresh fermented products

Starter culture

YO-MIX® Yogurt Culture
CHOOZIT® Culture
HOLDBAC® Protective Culture
Danisco® VEGE Culture
HOWARU® Probiotic strains

Texturants

GRINDSTED® PS Emulsifier
GRINDSTED® Pectin AMD &SY
GRINDSTED® ES/SB/Yo-Tex

Yogurt fruit preparation

Speciality Sweeteners
GRINDSTED® Pectin YF
GRINDSTED® Guar & LBG

Fermented base composition

Enzymes
Speciality sweeteners
Speciality pea & soy protein isolates

Process technology

State-of-the-art pilot facilities
Application expertize

Concepts addressing key consumer trends

Sugar-reduced fruited yogurt

Fruited yogurt with reduced sugar content without compromise on taste.

Sugar reduction

Ryazhenka spread

Ryazhenka spread is ryazhenka concentrated after fermentation to turn a drinkable product into a spreadable product.

Clean label

Probiotic almond shot

Feed a growing consumer appetite for plant-based product, while answering consumer needs around digestive wellness.

Plant-based

DUPONT Danisco

DuPont Nutrition & Biosciences is generally able to address all major current trends in the dairy industry

Sugar reduction

Cost optimization
(SMP, protein or fat reduction)

Healthy solutions
(Digestive, Immune, Weight management, Sports nutrition)

Ethnic dairy solutions

Lactose free solutions

Clean(er) labelling

Plant-based solutions

Indulgence