



TRansition paths to sUustainable
legume-based systems in EEurope

Regional legume situation in a globalised market with other alternative trends for (protein) food supply

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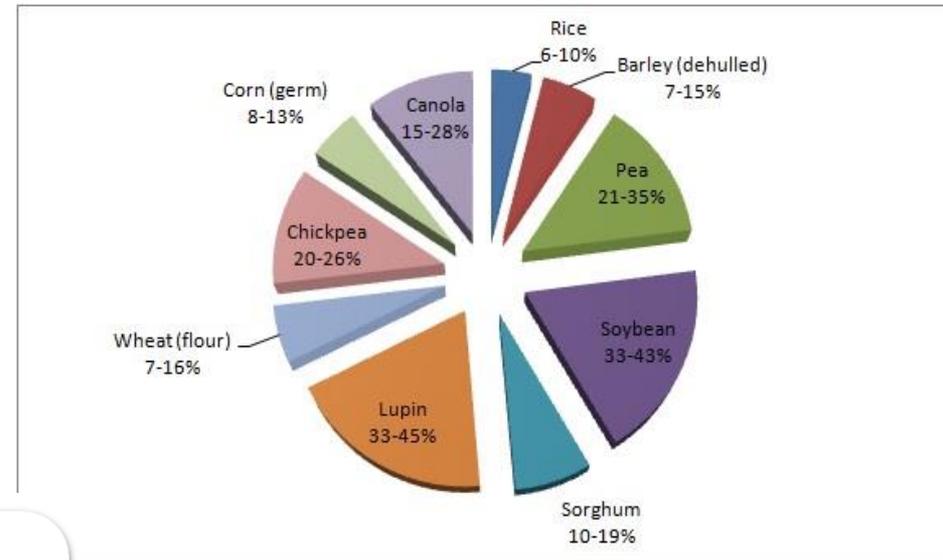




Generics to start with: protein content

Availability vs. strategy

(Source: J.I. Petrusán et al. 2017)





Most common grain legumes

Most grain legume species cultivated in Europe are ‘Mediterranean crops’. Soyabean is the only ‘tropical’ grain legume: a crop requiring four months of warm and rainy conditions to reach maturity.

	Pea	Faba bean	Blue lupin	White lupin	Yellow lupin	Chickpea	Common vetch	Bitter vetch	Soyabean
									
Existing types	S. and W.	S. and W.	S.	S. and W.	S.	S. and W.	W.	W.	S.
S.- Spring type sowing periods*	end winter	-	-	-	spring				
W.- Winter type sowing periods	late** autumn	mid autumn	-	early autumn	-	late autumn	early autumn	early autumn	-
Seed rate (kg/ha)	S: 200-300 W: 150-200	S: 200-300 W: 100-240	S: 150-200	S:150-200 W:80-140	S: 150-200	W: 120-150	W: 50-100	W: 90-110	120-160





Why legumes?

...for a well-balanced nutritional value

	Wheat	Pea	Faba bean	Common vetch*	Bitter vetch*	Chickpea Desi*	Blue lupin	White lupin	Yellow lupin**	Soyabean seed	
											
Components (% dry matter)	Proteins	12	24	29	28	26	22	34	38	42	39
	Starch	69	51	43	43	nd	41	0	0	0	0
	Fats	1.7	1.1	1.7	1.6	1.1	6.1	5.9	9.5	6.1	20
	Ash	1.8	3.5	4	4	3.3	3.2	3.8	3.9	3.8	5.9
	Crude fibres	2.5	6	9.3	4.5	4.1	10	16	13	18	5.9
Amino acids (% protein)	Lysine	2.9	7.3	6.5	5.7	6.4	6.8	5	4.9	5.3	6.2
	Methionine + cysteine	4	2.3	2	1.8	2.4	2	2.6	2.4	2.9	3.1
	Threonine	3.1	3.8	3.6	3.3	3.8	3.4	3.9	3.7	3.5	4
	Tryptophane	1.2	0.9	0.8	nd	nd	0.8	0.7	0.7	0.8	1.3

Sources: INRA, France (2002); *Iof Banque de données de l'alimentation animale - AFZ, France (2001); **GRDC, Australia (1997); nd = no data available.

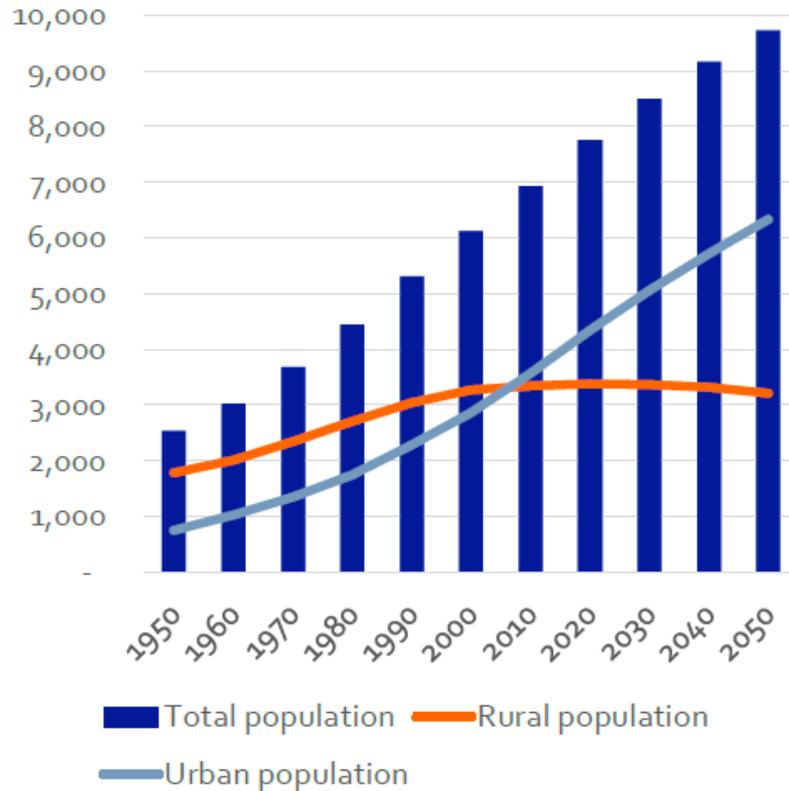


The global issue

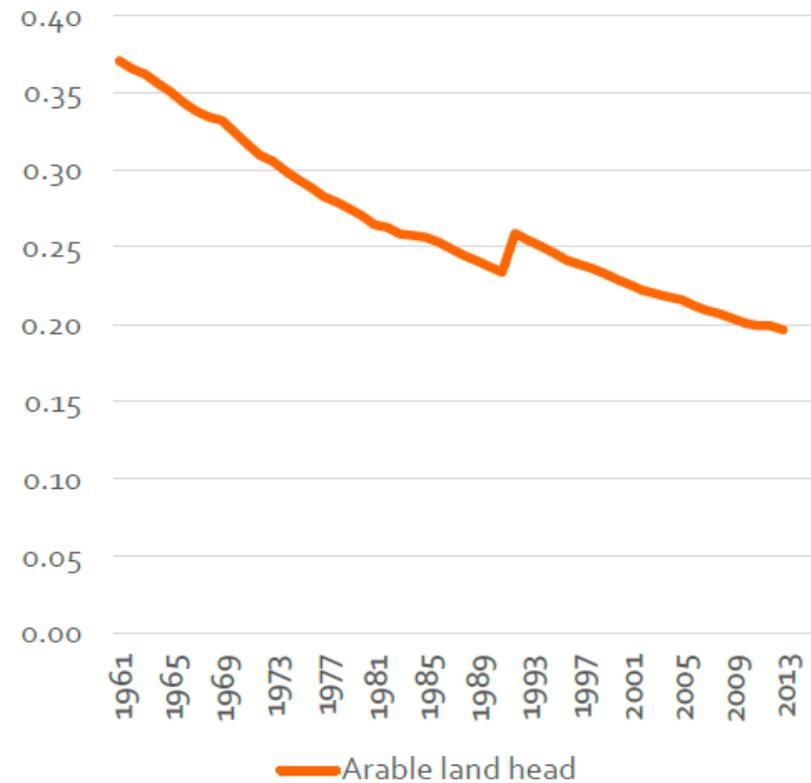
Population growth = More food
Welfare growth = More meat
Urbanisation = More food, less land



Population (million head)



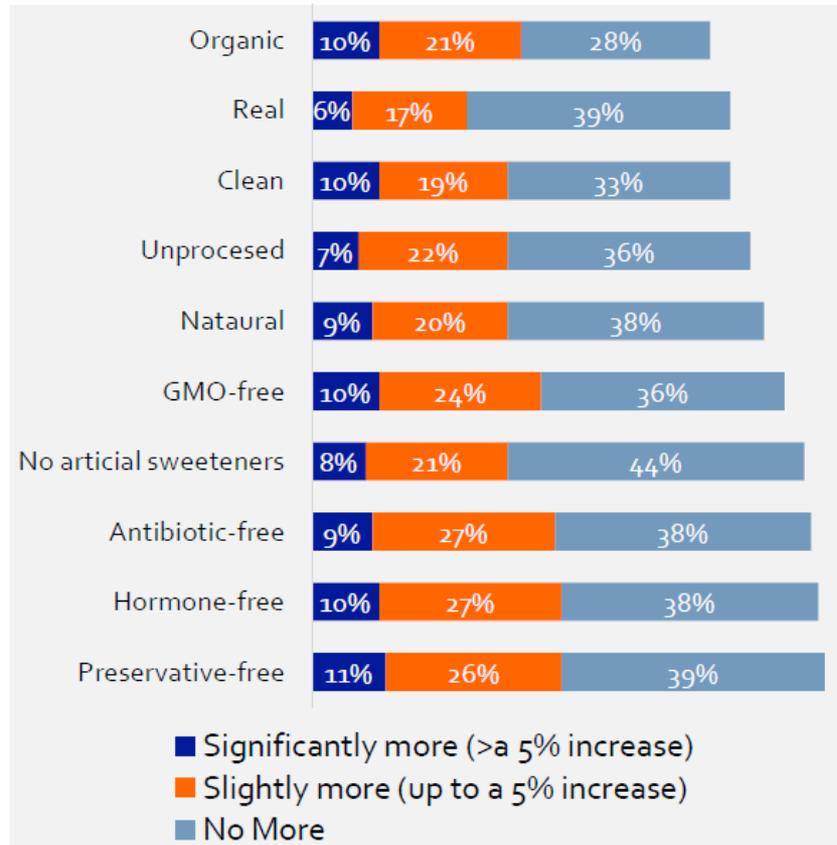
Arable land per head (ha)



Consumer preferences



Consumers are more likely to purchase and willing to pay for food described as:



Source: Technomic; Rabobank 2016

Simplicity
Free-from (and healthy)



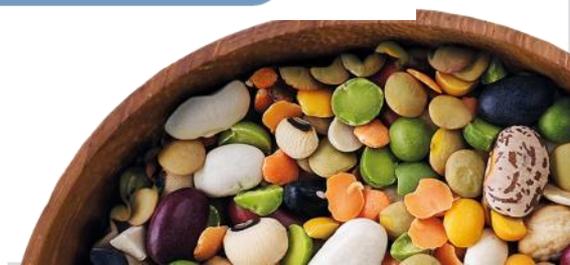
Authenticity
Natural (and good for me)



Trust
Transparent (and safe for me and for the planet)



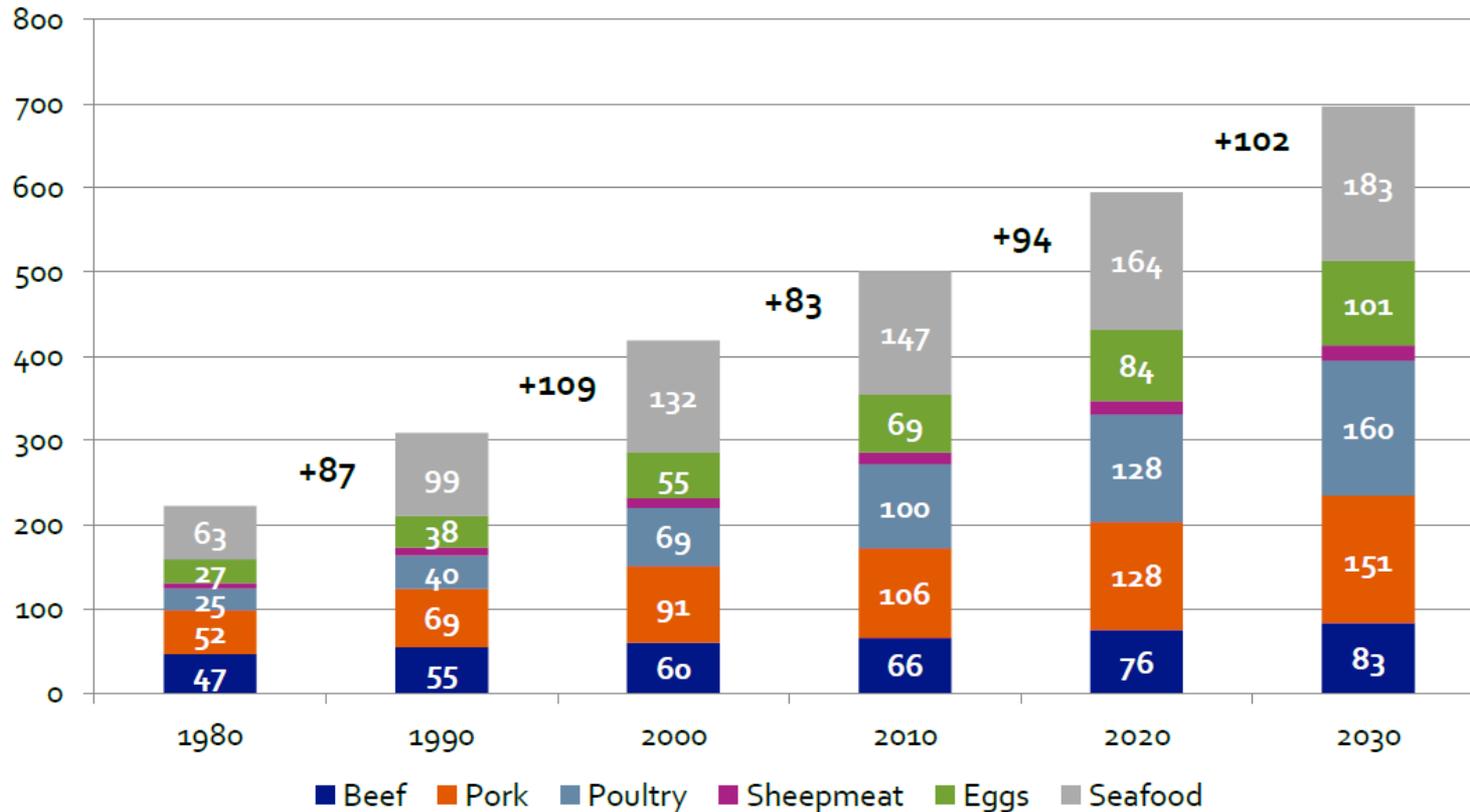
New consumer preferences



Meat demand continues to grow



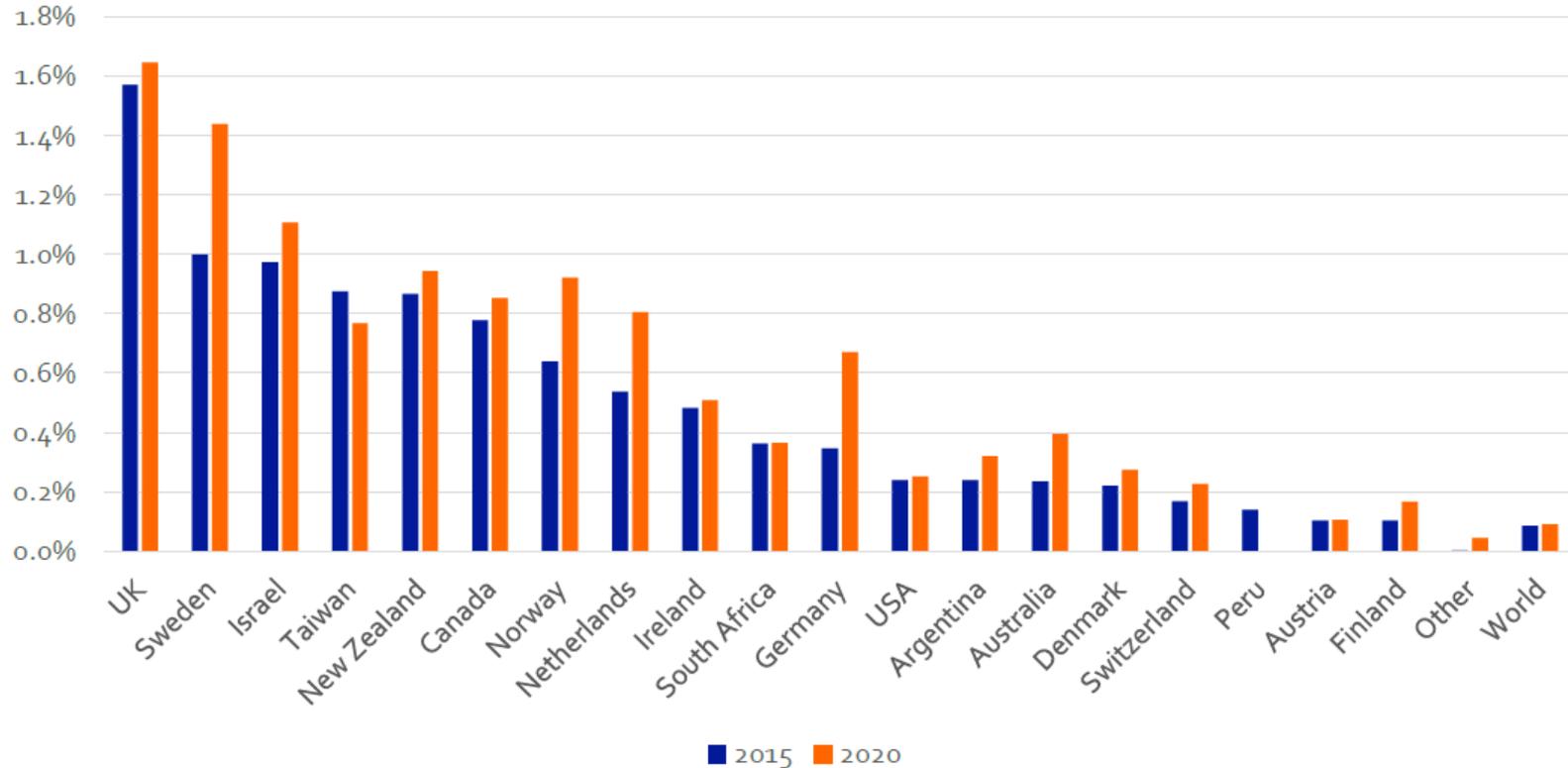
Global protein demand 1980-2030 (million tonnes)



Growth of meat substitutes occurs only in the developed world...



Share meat substitutes in total meat sales 2015, forecast 2020

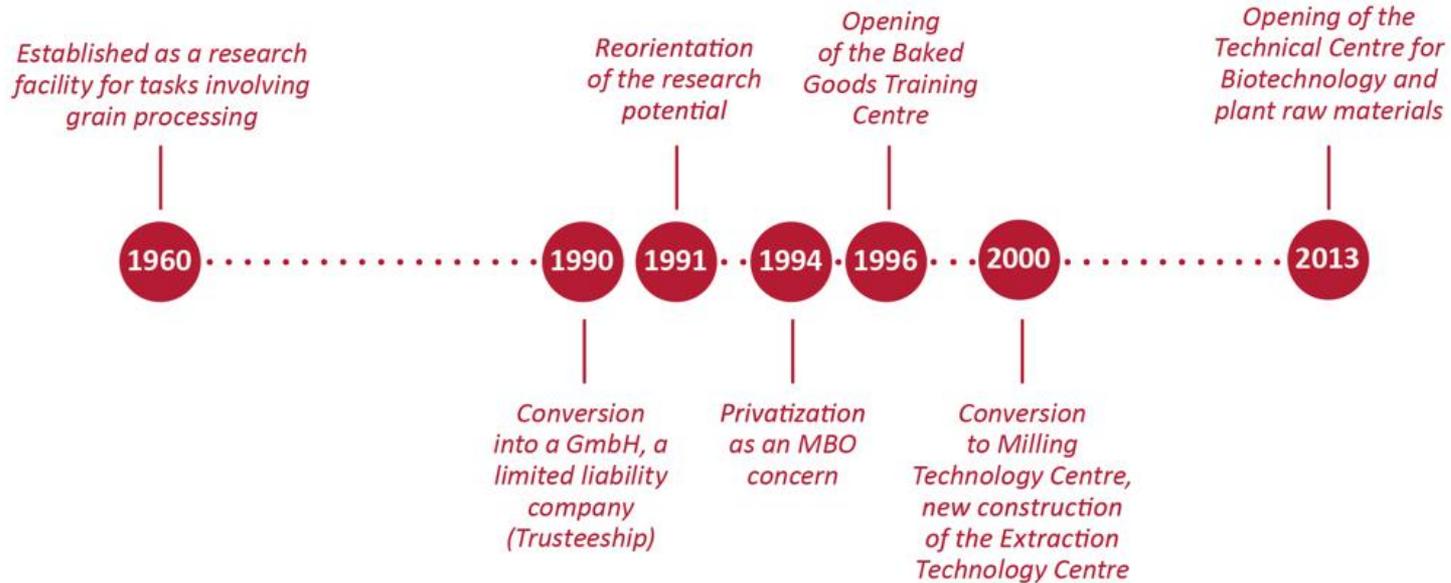


Source: Euromonitor. 2016





Who we are



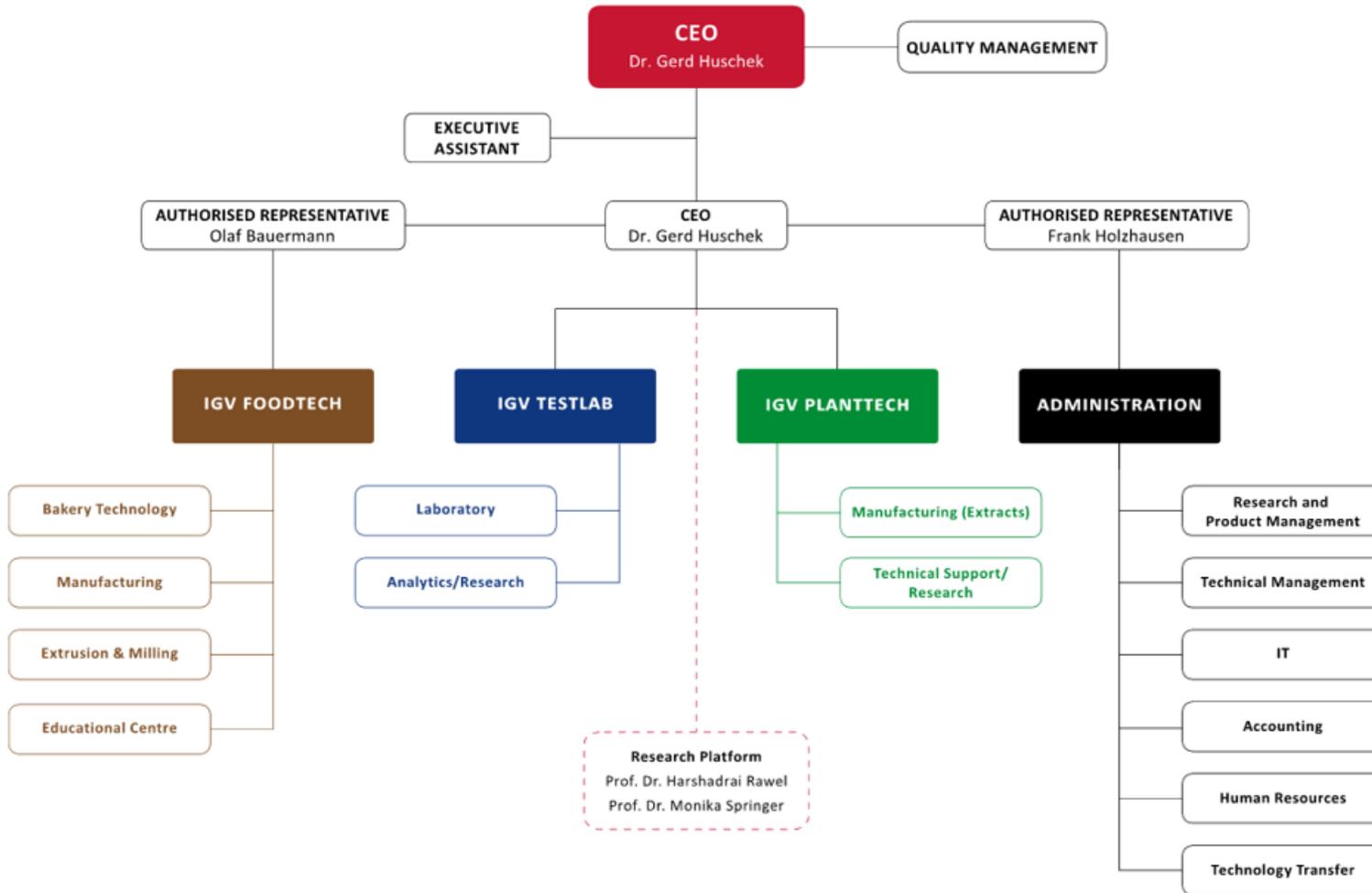
Our (legume&protein) capabilities



- ✓ *The development and manufacturing of products, systems, processes and services in the fields of grain processing, food and related products; **IGV FOODTECH***
- ✓ *The manufacturing and distribution of biomass extracts for food, nutritional supplements and cosmetics – **IGV PLANTTECH***
- ✓ *Lab Services to examine the marketability of food, feed, vegetal raw materials, pharmaceuticals and cosmetics raw materials based on European and German food and feed laws within our accredited test laboratory – **IGV TESTLAB***
- ✓ *Conducting of experimental or production trials in the fields of bakery products, extrusion and milling*
- ✓ *Providing scientific and technical services, the implementation of projects and education and training – **IGV RESEARCH PLATTFORM***



Structure of IGV



IGV's Products and Services for the Global Plant Protein Strategy



Plant proteins

- ✓ New protein ingredients
- ✓ Protein process innovation (technologies)

Plant extracts for the Beverage industry

- ✓ Protein and Sports Nutrition (healthy)

Protein flakes, Tablets (Nutritional Supplements)

- ✓ Vegetarian and Vegan Products
- ✓ Raw material safety through Proteomic analysis for products

Proteins, essential amino acids, vit. B12

biomarkers research, microorganisms

via LC/MS/MS, Triple TOF/MS, MalDI/TOF/MS, electrophoresis

➔ **Production for the industry and retail**

IGV pea protein products

- ✓ Protein flakes for muesli



- ✓ From pea protein
- ✓ Absolute Vegan
- ✓ Allergen-free
- ✓ Gluten-free
(May contain traces of gluten)
- ✓ GMO-free
- ✓ 62 g protein/100 g



IGV basic vegan pea protein extrudates - advantages



Nuggets

1. Application of pea protein
2. Absolutely vegan
3. Allergen-free, Gluten-free, *Free of GMO*
4. Good digestion by customer
5. *Full meat substitute with higher biological value than whey protein*
6. *Nutritional claim: „high protein content“, according to EC (No.) 1924/2006) - 76 g protein/100 g*
7. *12 months shelf-life: storage without cooling (microbiological stability)*



Crispies



pasta

- ✓ application of pea / linseed protein
- ✓ Vegan or Vegetarian
- ✓ Allergen-free, Gluten-free, free of GMO
- ✓ 24 g protein/100 g



pasta



Basic- and System applications



Protein-Strategy: vegan, allergen-free, GMO-free

IGV-Basic-Product

IGV-System-Product

ProteinCRISPIES



Pre-Mix (Binder, spices)



Producible final products for the consumer

ProteinCRISPIES

ProteinCRISPIES

ProteinCRISPIES

ProteinCRISPIES

ProteinCRISPIES

ProteinCRISPIES

Protein-Bar

Muesli

Vegan Bolognese

+ Pre-Mix
Fried vegan meatballs

+ Pre-Mix
Vegan Burger-Patties

+ Pre-Mix
Cooked vegan meatballs



IGV application spectrum of dry pea extrudates



Distribution of products

Basic-Product

System-Product

ProteinCRISPIES

ProteinCRISPIES

ProteinCRISPIES

Pre-Mix (Binder, spices)



delivered in Big Bags

delivered in Big Bags

delivered in Big Bags

Delivered in Bulk



industrial customer/wholesaler

Privat Label

industrial customer
+ Pre-Mix (Binder, spices)

wholesaler



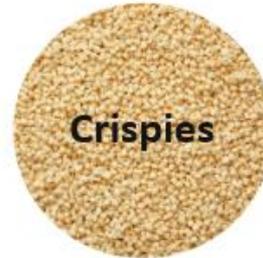
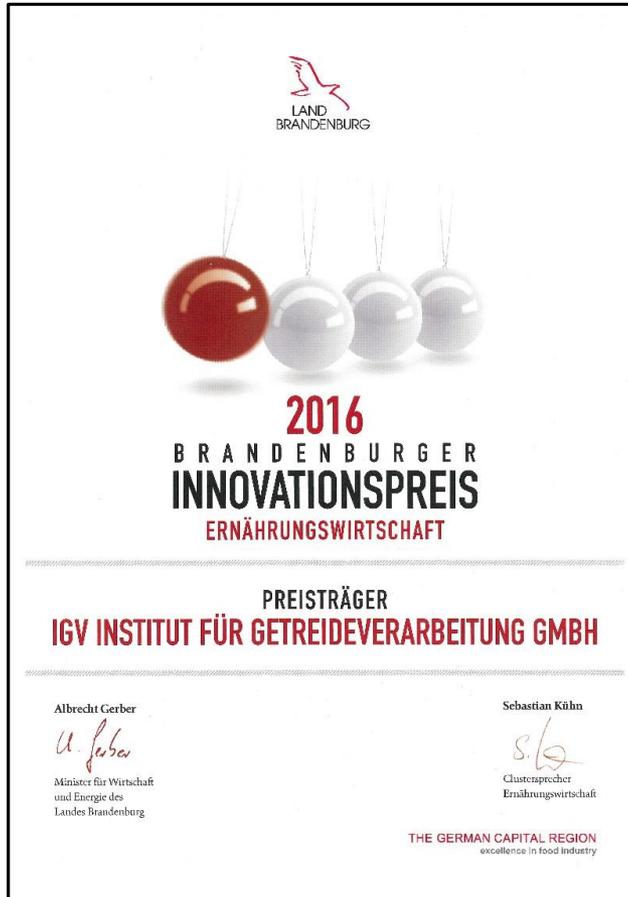
Bulk consumer products

retail

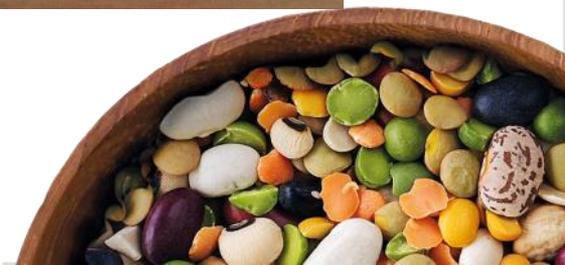
retail

Bulk consumer products





Bridge2Food Lille: Award Most Novel Ingredients 2016 for Protein market





Biological activity compared with whey protein

eAS [g/kg]	WP (references)	WP (Retail)	Pea-Isolate 40%	IGV* Protein-crispies	IGV Chlorella-Extract	IGV Spirulina-Extract	120g* Portion per Day
Isoleucine	70,0	43,4	3,2	34,5	23,9	31,1	4,2 g
Leucine	115	91,1	4,5	63,0	53,6	46,9	7,6 g
Lysine	101	74,6	8,1	56,2	39,9	34,8	6,7 g
Methionin	23,0	20,7	0,9	10,9	11,1	13,5	1,3 g
Phenylalanin	33,0	29,1	3,4	42,9	27,4	26,1	5,2 g
Threonine	76,0	42,3	4,7	28,5	31,6	28,2	3,4 g
Tryptophan	22,0	16,6	0,7	5,9	7,5	6,20	0,7 g
Valine	64,0	41,3	4,3	38,3	38,5	33,8	4,6 g
AS, gesamt	1099	839	101	703	666	567	1-3,0 fache
Protein g/100g	70-80	60-70	12,5	76,0	49,5	57,4	
Vitamin B12	0,4 µg / 100g				100 -150 µg / 100g	100- 150 µg/ 100g**	

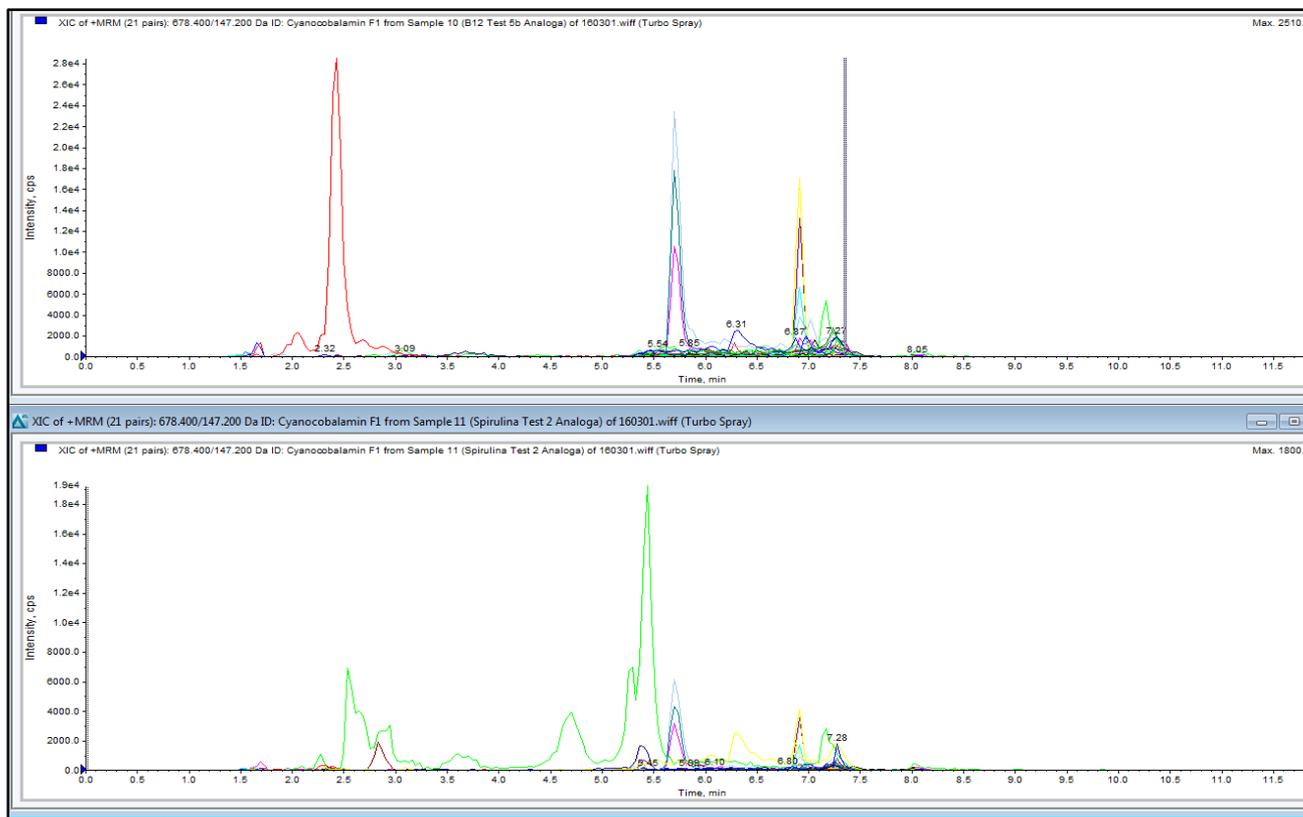
Weight of Adult, kg	80 kg
Essential AA	g pro Tag
Isoleucine	1,6
Leucine	3,12
Lysine	2,4
Methionin	1,2
Phenylalanin	2,0
Threonine	1,2
Tryptophan	0,32
Valine	2,08
Protein in g per Day	120 g
Vitamin B12	4 µg



Which forms of Vitamin B12 are available in algae?



Vitamin B12 has an effect on almost all aspects of our health. As an important coenzyme it is needed for the metabolism of all reproductive cells and particularly affects blood formation, the protection of nerve cell division, DNA synthesis, the production of neurotransmitters, the energy and protein metabolism.



Biological intermediary forms:

Cyanocobalamin (synthetic),
Hydroxocobalamin

Biologically active Coenzyme-
Forms: Adenosylcobalamin,
Methylcobalamin

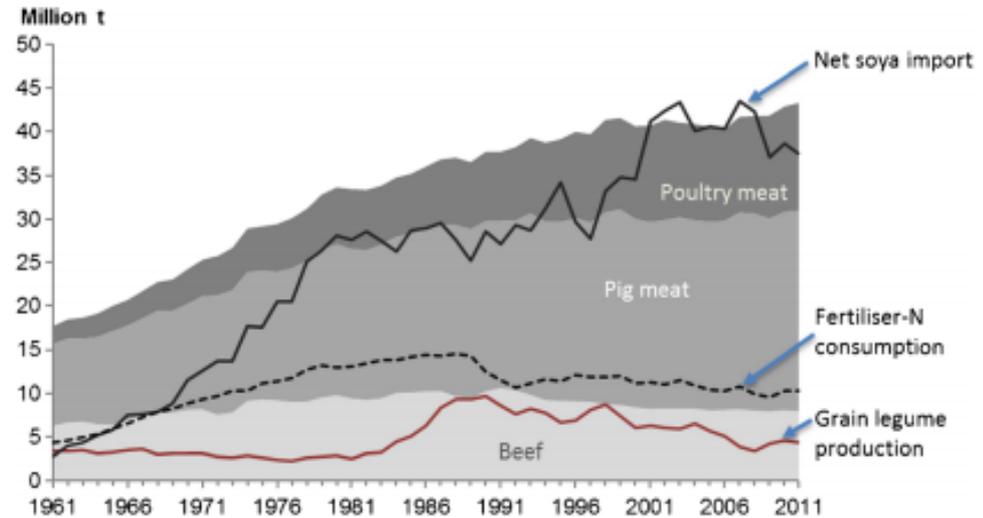
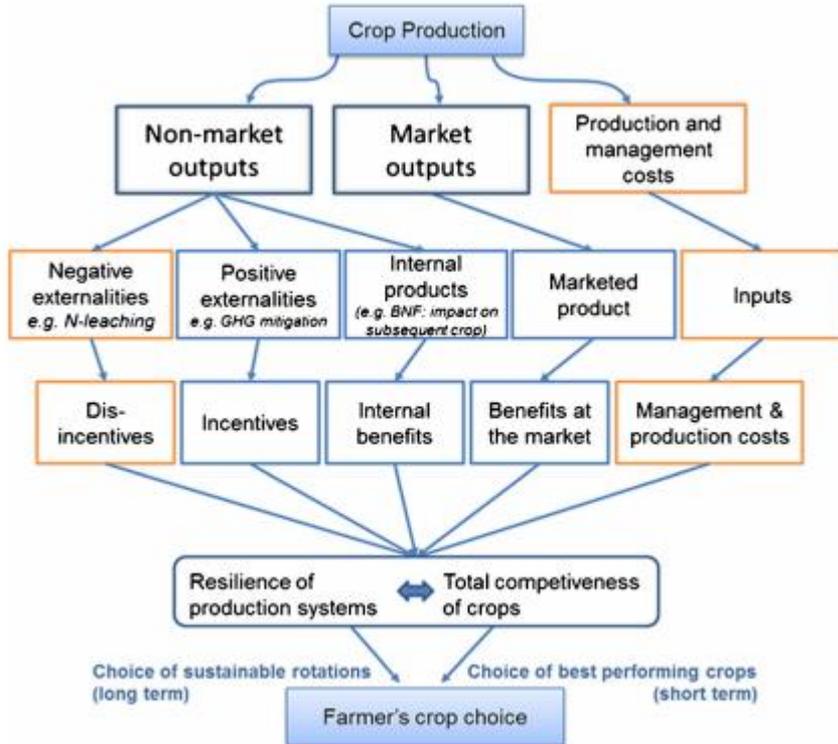
Biologically inactive forms:

Analogues (Pseudo-Vitamin B12-
Molecules)

- Analysis of the 4 forms and Analogues via LC-MS/MS
- Green and Red Analogues



Factors influencing legume market



Soil and climatic conditions determine the spread of different legumes across Europe



Adaptation	Pea	Faba bean	Blue lupin	White lupin	Yellow lupin	Chickpea	Common vetch	Bitter vetch	Soyabean
Calcareous soils active CaCO ₃ > 2 %	++	++	--	--	--	++	++	++	++
Shallow soils susceptible to drought	+	-	++	+	++	++	++	++	-
Stony soils with lodging and harvesting problems	+*	++	++	++	++	+	-	-	+
Tolerance of waterlogged soils	+	++	+	+	+	+	+	+	++

* only for varieties with good standing ability.

Adaptation /tolerance

+++ : perfect
 ++ : good
 + : moderate
 - : low
 -- : avoid
 nd : not determined

Which climatic constraints?

Tolerance	Pea	Faba bean	Blue lupin	White lupin	Yellow lupin	Chickpea	Common vetch	Bitter vetch	Soyabean
Tolerance of high temperature	+	-	+	+	+	++	nd	nd	+++
Tolerance of drought stress	+	-	++	+	++	++	++	++	-
Cycle duration* (Spring types)	1,600	1,900	nd	2,100	nd	nd	nd	nd	variable**
Frost resistance (Winter types)	++ to +++	+ to ++	nd	+	nd	+	++	++	- -

* in degree.days (° C.days) Base 0°C; ** different maturity groups.



General contact information

Website: www.true-project.eu

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Facebook/Twitter: [@TrueLegumes](https://www.facebook.com/TrueLegumes)



IGV contact information

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TRransition paths to **sU**ustainable legume-based systems in **E**urope (**TRUE**) has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 727973

