



The European Legume Hub

Presentation to the

Expert Group Crops Market Observatory

4 October 2021

Legumes Translated (Translating knowledge for legume-based farming for feed and food systems) has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817634



Legumes: much discussed.

But what is a legume?



Photo: Donal Murphy-Bokern



Photo: Donal Murphy-Bokern

Why are legumes the focus of attention?

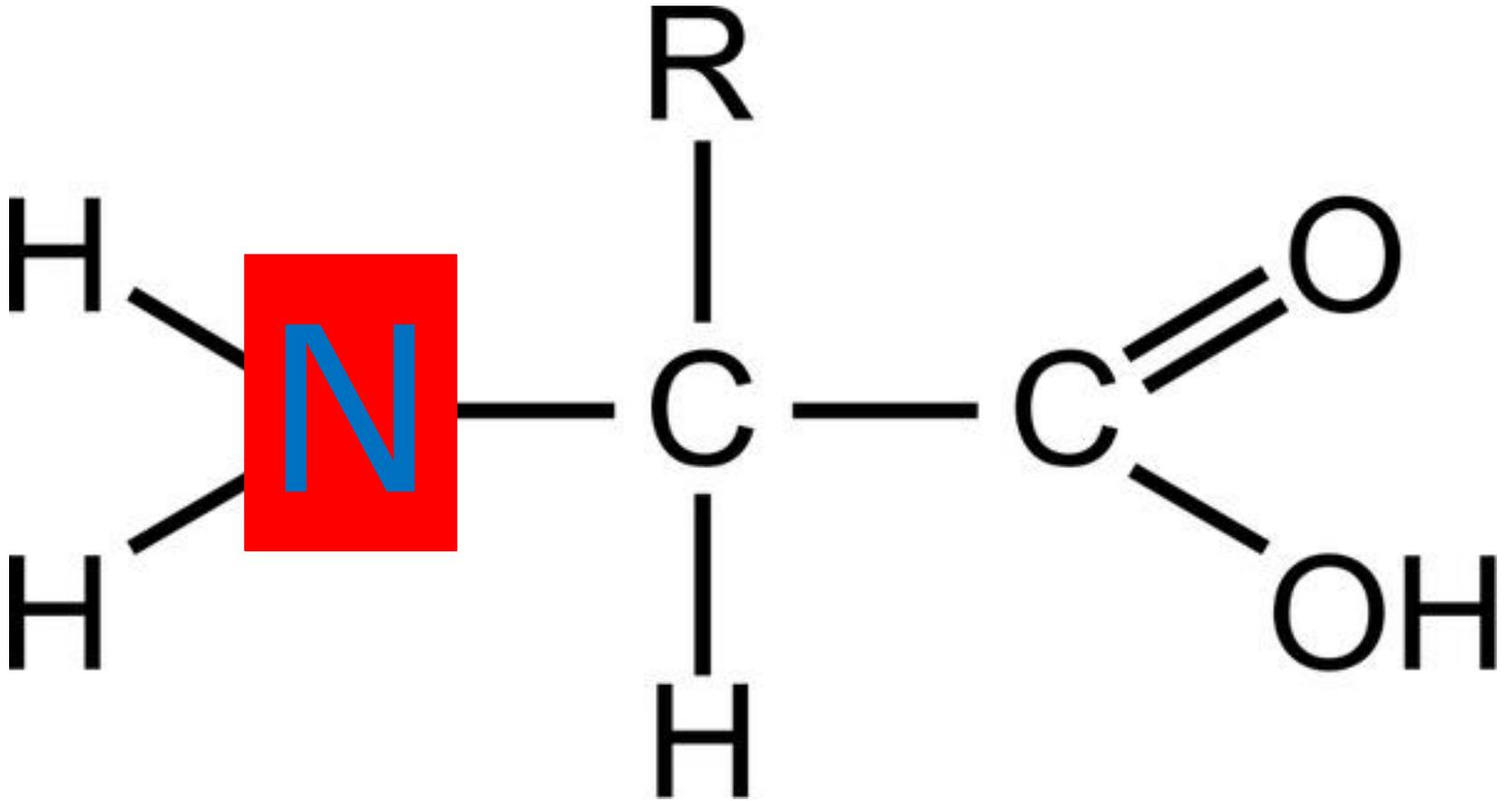


Photo: Leo Rittler



Photo: Monika Messner, FiBL

Amino acids: the building blocks of protein and life



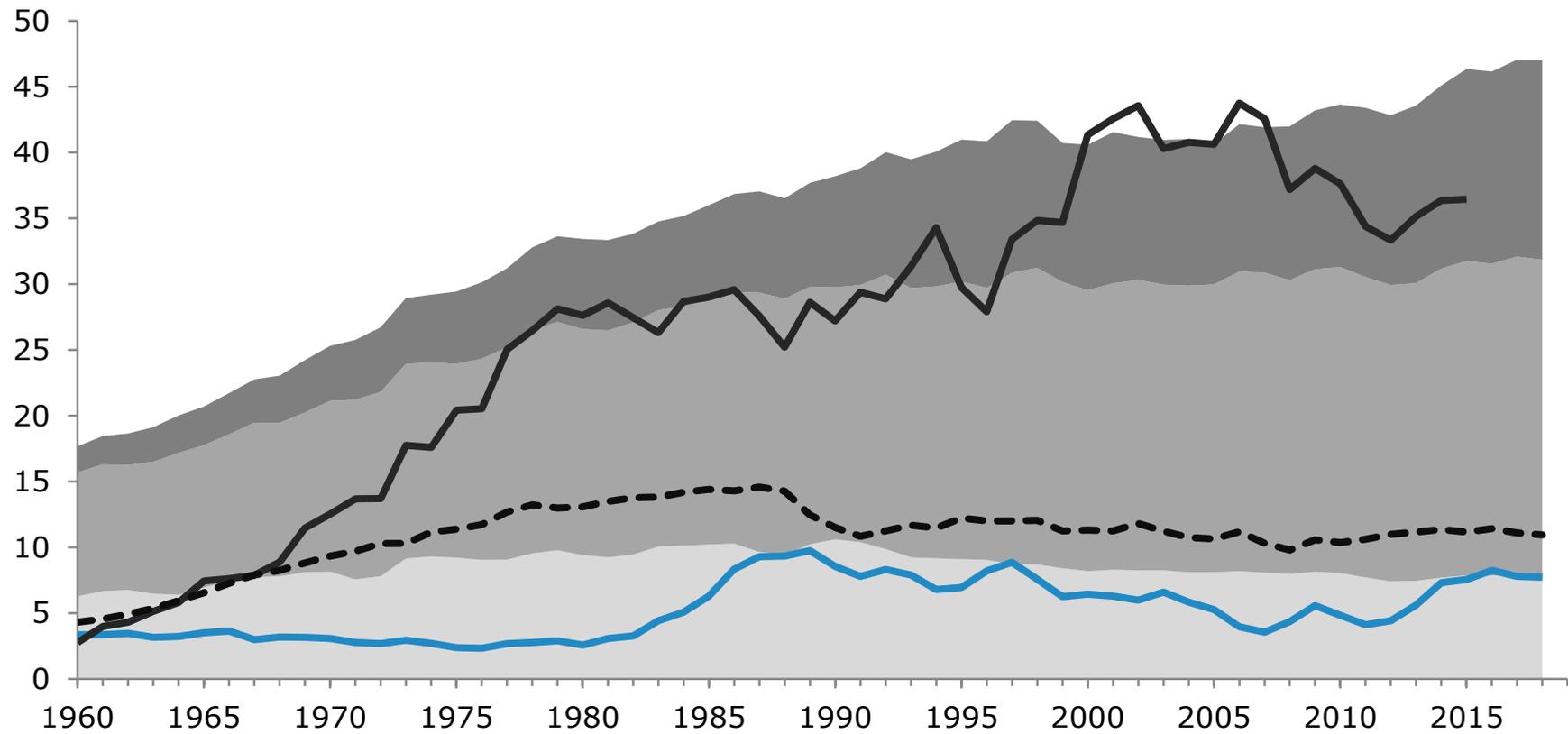


The role of legumes in our agri- food system



Livestock production drives the protein deficit

Million tonnes



- Beef
- Poultry meat
- Net soya import (bean equivalent)
- Pig meat
- Grain legume production
- Fertiliser-N consumption

EU Feed Protein Balance Sheet

2019/20	Million tonnes						Protein content (feed use) (G)	Million tonnes (crude protein)			
	Protein source	Total EU production (A)	EU imports (B)	EU exports (C)	Total EU domestic use (D)	EU total feed use (E)		Feed use EU origin (F)	EU total feed use (E) = (E) + (F)	Feed use EU origin (F) = (F) + (G)	% feed use of EU origin (H) / (E)
CROPS					181.7	161.0		18.36	16.55	90%	22%
CEREALS (of which)	319.6	24.9	49.9	294.6	176.6	156.3		17.00	15.30	90%	20%
Common wheat	147.0	2.1	33.0	116.1	49.8	47.7	11.0%	5.48	5.25		
Berley	63.1	0.6	10.5	53.2	37.2	37.2	10.0%	3.72	3.72		
Durum	7.5	2.0	1.2	8.3	0.4	0.4	12.0%	0.05	0.04		
Maize	70.1	20.0	4.7	85.4	68.5	50.5	8.0%	5.48	4.04		
Rye	8.3	0.0	0.3	8.1	2.5	2.5	11.0%	0.28	0.28		
Sorghum	1.0	0.1	0.0	1.0	0.5	0.4	11.0%	0.05	0.05		
Oats	7.8	0.0	0.2	7.7	5.7	5.7	11.0%	0.63	0.63		
Triticale	11.0	0.0	0.0	11.0	8.7	8.7	11.0%	0.96	0.96		
Others	3.8	0.2	0.0	3.9	3.3	3.2	11.0%	0.36	0.35		
OILSEEDS (feed use without crushing) (columns (E) and (F))	29.9	22.2	0.7	51.4	1.6	1.6		0.46	0.46	100%	1%
Soya beans	2.7	15.3	0.2	17.8	1.2	1.2	33.0%	0.40	0.40		
Rapeseed	17.1	5.8	0.1	22.9	0.2	0.2	18.8%	0.03	0.03		
Sunflowerseed	10.1	1.1	0.5	10.7	0.2	0.2	14.8%	0.03	0.03		
PULSES (of which)	4.2	0.6	0.4	4.4	3.6	3.1		0.90	0.78	87%	1%
Field peas	2.2	0.4	0.1	2.5	1.9	1.7	22.5%	0.43	0.38		
Broad beans	1.7	0.0	0.3	1.5	1.2	1.2	28.0%	0.32	0.32		
Lupins	0.3	0.2	0.0	0.5	0.4	0.3	35.0%	0.16	0.09		
CO-PRODUCTS					85.9	45.3		25.88	9.48	37%	31%
OILSEED MEALS	30.1	24.2	1.3	53.0	52.8	14.3		21.07	4.96	24%	25%
SOYA BEAN MEALS (of which)	11.6	18.5	0.3	29.8	29.6	1.0		13.51	0.43	3%	16%
Soya bean meal (from EU soya bean production)	1.0			1.0	1.0	1.0	43.0%	0.43	0.43		
Soya bean meal (imported soya bean crushing)	10.3		0.3	10.6	9.8	0.0	45.5%	4.47	0.00		
Soya bean meal (traded as such)		18.5		18.5	18.5	0.0	45.5%	8.42	0.00		
Soya bean protein concentrate	0.3			0.3	0.3	0.0	62.5%	0.19	0.00		
RAPESEED MEALS (of which)	12.6	0.3	0.4	12.5	12.5	9.0		4.11	2.36	72%	5%
Rapeseed meal (from EU rapeseed production)	9.4		0.4	9.0	9.0	9.0	33.0%	2.96	2.96		
Rapeseed meal (imported rapeseed crushing)	3.2			3.2	3.2	0.0	33.0%	1.05	0.00		
Rapeseed meal (traded as such)		0.3		0.3	0.3	0.0	33.0%	0.10	0.00		
SUNFLOWER MEALS (of which)	5.2	3.3	0.5	8.0	8.0	4.2		2.90	1.51	52%	3%
Sunflower meal (from EU sunflowerseed production)	4.7		0.5	4.2	4.2	4.2	36.0%	1.51	1.51		
Sunflower meal (imported sunflowerseed crushing)	0.5			0.5	0.5	0.0	36.0%	0.19	0.00		
Sunflower meal (traded as such)		3.3		3.3	3.3	0.0	36.0%	1.19	0.00		
OTHER OIL SEED MEALS (of which)	0.6	2.1	0.1	2.6	2.6	0.1		0.55	0.05	9%	1%
Peanut meal	0.0	2.0	0.0	2.0	2.0	0.0	16.0%	0.32	0.00		
Linseed meal	0.4	0.0	0.0	0.5	0.5	0.0	34.0%	0.16	0.00		
Other oilseed meals	0.2	0.1	0.1	0.2	0.2	0.1	37.0%	0.07	0.05		
OTHERS CO-PRODUCTS	34.0	4.0	1.2	36.7	33.1	31.0		4.81	4.53	94%	6%
Starch industry's medium protein products (15-30%)	4.0	0.4	0.5	3.9	4.0	4.0	19.0%	0.76	0.76		
Starch industry's super protein products (60-90%)	1.1	0.0	0.0	1.1	0.7	0.7	73.0%	0.51	0.51		
Distillers' dried grains with solubles	3.4	0.7	0.3	3.8	3.8	3.1	30% wheat 27% maize	1.11	0.93		
Wet distillers' grain	6.8	0.0	0.0	6.8	6.8	6.8	5.4%	0.37	0.37		
Wheat bran	8.3	0.0	0.2	8.1	8.1	8.1	15.5%	1.26	1.26		
Citrus pulp	0.0	0.2	0.0	0.2	0.2	0.0	7.5%	0.02	0.00		
Beet pulp pellets	6.8	1.2	0.1	7.9	7.9	6.7	7.9%	0.62	0.53		
Molasses	3.5	1.5	0.1	4.9	1.6	1.6	10.7% beet 4.2% cane	0.17	0.17		
NON-PLANT SOURCES					8.2	8.0		2.16	2.04	94%	3%
(excluding on-farm use)											
Fish meal	0.5	0.3	0.2	0.6	0.6	0.5	65.0%	0.39	0.30		
Whey powder	2.0	0.1	0.7	1.3	0.6	0.6	12.5%	0.07	0.07		
Skimmed milk powder	1.5	0.0	0.9	0.6	0.1	0.1	34.0%	0.05	0.05		
Processed animal proteins	2.6	0.1	0.8	1.9	1.9	1.8	62.3%	1.18	1.14		
Former feedstuff					5	5	8.5%	0.48	0.48		
ROUGHAGE					1332	1332		38	38	100%	45%
Grass	1019			1019	1019	1019	2.5%	25	25		
Silage maize	247			247	247	247	2.9%	7	7		
Fodder legumes	65			65	65	65	7.2%	5	5		
Dried fodder	3.3	0.0	1.9	1.4	1.4	1.4	17.0%	0.2	0.2		
TOTAL								84	66	78%	

Legend

Low-Pro: Less than 10% protein content
 Medium-Pro: 10-30% protein content
 High-Pro: 30-50% protein content
 Super-Pro: Over 50% protein content

56.15	54.35	97%
4.46	3.91	86%
21.17	5.50	26%
2.27	1.95	86%

There is only limited inter-changeability between proteins from different categories, for instance between proteins from cereals and proteins from soya meal (due to its amino acid pattern, soya protein is used more efficiently than other plant proteins in animal nutrition).

Table 2.4. The European Union (EU) tradable plant protein balance – net import, EU production and use of protein in feed or food.^a

	Net import	Production	Use in animal feed	Use in food
Crop quantities (million t)				
Soybean	36.9	1.3	38.1	0.1
Oilseed rape	2.7	19.3	22.0	0.0
Sunflower seed	4.9	8.5	13.4	0.1
Other oilseeds	3.5	0.0	3.5	0.0
Pea	0.1	1.6	0.8	0.9
Faba bean	0.2	1.1	1.2	0.9
Fruit and vegetables	14.0	192.7	8.9	198.5
Cereals	-15.6	293.1	167.7	110.9
Forage maize (DM) ^b	0.0	55.0	55.0	0.0
Protein quantities (million t)				
Soybean	15.13	0.53	15.62	0.04
Oilseed rape	0.57	4.05	4.6	0.00
Sunflower seed	0.68	1.45	2.13	0.00
Other oilseeds	0.91	0.00	0.91	0.00
Pea	0.02	0.38	0.19	0.21
Faba bean	0.06	0.46	0.30	0.22
Fruit and vegetables	0.14	1.93	0.09	1.98
Cereals	-1.80	29.06	16.38	10.88
Total 'tradable' crops	15.71	37.86	40.24	13.33
Forage maize	0.0	3.85	3.85	0.0
Total from arable crops	15.71	41.71	44.09	13.33

The EU is 70% self-sufficient in arable plant protein

European Protein Strategy



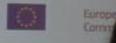


THE DEVELOPMENT OF PLANT PROTEINS IN THE EUROPEAN UNION

OPPORTUNITIES AND CHALLENGES

Phil Hogan
European Commissioner for Agriculture
and Rural Development

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President of the
Council of the
European Union

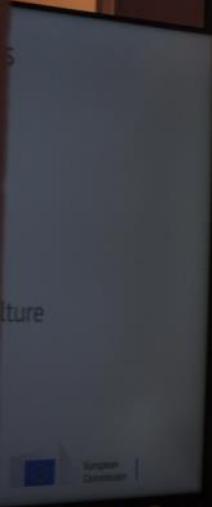


Austrian
President of the
Council of the
European Union

Federal Ministry
Republic of Austria
Austrian Ministry and Trade

P. Hogan
European Commissioner for
Agriculture and Rural
Development

THE DEVELOPMENT OF PLANT PROTEINS
IN THE EUROPEAN UNION
OPPORTUNITIES AND CHALLENGES
DIE ENTWICKLUNG VON EINWEISSPFLANZEN
IN DER EUROPÄISCHEN UNION
OPPORTUNITÄTEN UND HERAUFGEFORDERTHEITEN
22 & 23 NOVEMBER 2018 - VIENNA/WIEN





Brussels, 22.11.2018
COM(2018) 757 final

**REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN
PARLIAMENT**

on the development of plant proteins in the European Union



- 5. Increase sharing of knowledge/best practice in supply chain management and sustainable agronomic practices and bundle information on research activities in breeding, technical innovation and processing, e.g. on a dedicated knowledge platform**

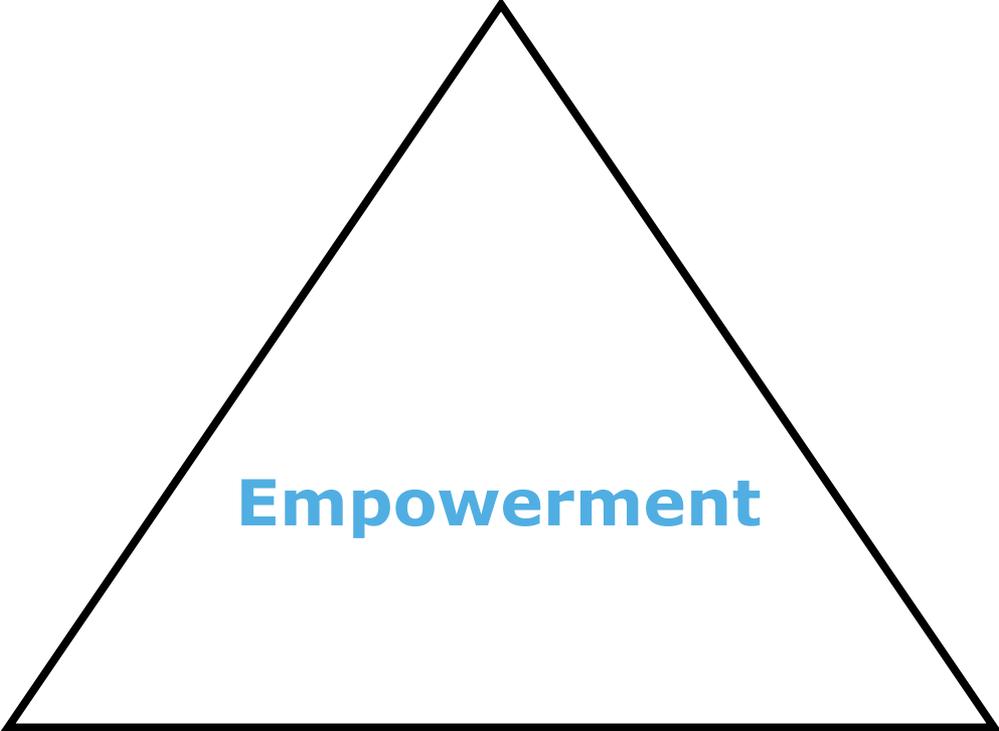
The Commission calls for a continued debate – with Member States, the European Parliament and other stakeholders – on how best to stimulate regional and national approaches and so unlock the economic potential of plant proteins, using current and future policy instruments for a further growth of plant protein production in the EU.

The Legume' Hub



The Legume Hub

**A self-publishing
knowledge platform**



Empowerment

**Mutually
'owned'**

**A community
(association)**

Europe's knowledge platform for legumes

provided by
The European Legume Hub Community

Search

Our recent articles



Sowing time for soybean

Timely sowing is important for successful soybean production. Timely sowing gives the best combination of cultivar, the length of daylight (latitude and calendar date), and soil temperature and moisture at planting depth. This enables rapid development and growth of young plants before floral induction, providing the foundatio...

Leopold Rittler, Olga Bykova



Feeding quality of pea for poultry

This note gives an overview of the components and feed value of field pea. Pea (*Pisum sativum* L.) is rich in protein and energy. Pea complements cereal in the feed ration because of the high content of lysine. The feed value of pea for poultry is determined by the metabolisable energy for poultry and the digestibility of the amino acids. Depending o...

Ulrich Quendt



Cultivation of white lupin

White lupin (*Lupinus albus*) is a different botanical species to narrow-leaved or „blue“ lupin (*Lupinus angustifolius*). It tolerates heavier soil and has a higher yield potential, but does not ripen until August/September. Important cultivation practices include the use of healthy, certified seed, sowing as early as possible and using the right ...

Christine Amcken, Matthias Klais, Marina Wendling and Monika Messmer

Content 1: Original Hub article (self-published)

Winter pea in south-east Europe

Anelia Iantcheva, Viliana Vasileva

Posted: 24.09.2021

Winter pea (*Pisum sativum ssp. arvense* L.) is widely grown in Bulgaria. Bulgarian scientists and farmers have accumulated cultivars and knowledge for both forms of field peas, winter and spring pea (*Pisum sativum ssp. sativum* L.). There is renewed interest in pea as farmers and local producers aim to apply circular economy in agriculture. Local production of plant protein has a positive economic effect in animal husbandry. Bulgaria is characterised by favorable climatic conditions and suitable soils for over-wintering field pea. Autumn-sown winter pea is particularly flexible in how the canopy and crop structure develops. The high plasticity of winter pea as a crop and its ability to enrich the soil with nitrogen, as well as the available local pool of cultivars, are prerequisites for selecting it as a source of sufficient plant protein in local circular economy.

♦ ♦ ♦ ♦

About this article

Authors: Anelia Iantcheva, Viliana Vasileva

Publisher: AgroBioInstitute (ABI)

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Acknowledgement: Legumes Translated has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 817634.

Citation: Iantcheva, A. and Vasileva, V., 2021. Winter pea in south-east Europe. Legume Hub. www.legumehub.eu

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Funded by the
European Union



Legumes
Translated

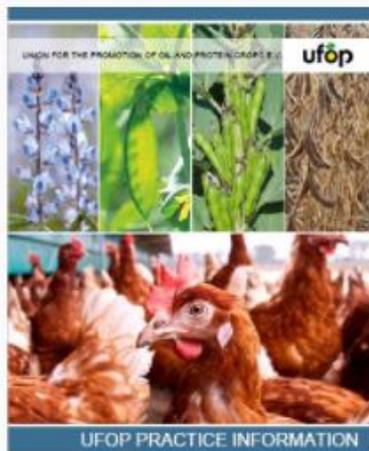


Content 2: Existing articles in members' portfolios

Faba bean, grain pea, sweet lupin and soybean in poultry feeds

Gerhard Bellof, Ingrid Halle and Markus Rodehutschord

Posted: 15.07.2021



 Download



Content 3: Video

Bean weevil in faba bean

Martin Bourke

Posted: 17.05.2021



Multilingual contributions



The screenshot shows the Legume Hub website interface. At the top left is the Legume Hub logo. The top navigation bar includes links for 'О нас', 'Наши проекты', 'Наши участники', and 'Новости'. A search bar is present, and a language dropdown menu is open, showing options for 'RU', 'EN', and 'RO'. A red arrow points to the 'RU' option. Below the navigation bar, there are menu items for 'Культуры', 'Животные', 'Еда', and 'Фото'. A 'Join us' button is also visible. The main content area features an article titled 'Клещи в производстве сои' by Željko Milovac, Kristina Petrovic, Svetlana Balesevic Tubic, Jürgen Recknagel, and Marjana Vasiljević, published on 17.09.2021. The article text discusses the challenges of mite infestation in soybean production in Europe. A sidebar on the right titled 'Последний' lists categories like 'Статьи', 'Видео', and 'Новости', along with a 'По теме' section containing related articles.

О нас Наши проекты Наши участники Новости Поиск RU EN RO

Культуры Животные Еда Фото Join us

Клещи в производстве сои

Željko Milovac, Kristina Petrovic, Svetlana Balesevic Tubic, Jürgen Recknagel, Marjana Vasiljević
опубликовано: 17.09.2021

Вредители, как правило, не являются проблемой при выращивании сои в Европе. На долю паутиных клещей приходится значительная доля повреждений, причиняемых вредителями. Риск повреждения высок в сухую и жаркую погоду летом. Несколько видов клещей могут повреждать растения сои, но два из них наиболее опасны, чем другие: паутиный клещ (*Tetranychus atlanticus*) и двухпятнистый паутиный клещ (*Tetranychus urticae*). В Европейском Союзе (ЕС) нет акарицидов, доступных для использования на сое, и химическая борьба не является вариантом в ЕС или для культур, выращенных по стандартам ЕС в других странах.

Последний

Статьи
Видео
Новости

По теме

Биологическая фиксация азота бобовыми культурами
Метод холодного проращивания семян сои
Сроки посева сои

Искать статьи ...



Joining the Legume Hub

Legume Hub

Registration

Username *

We recommend to enter here your first name and surname. The username will be used by the Legume Hub's software system in addressing you.

Email *

Password *

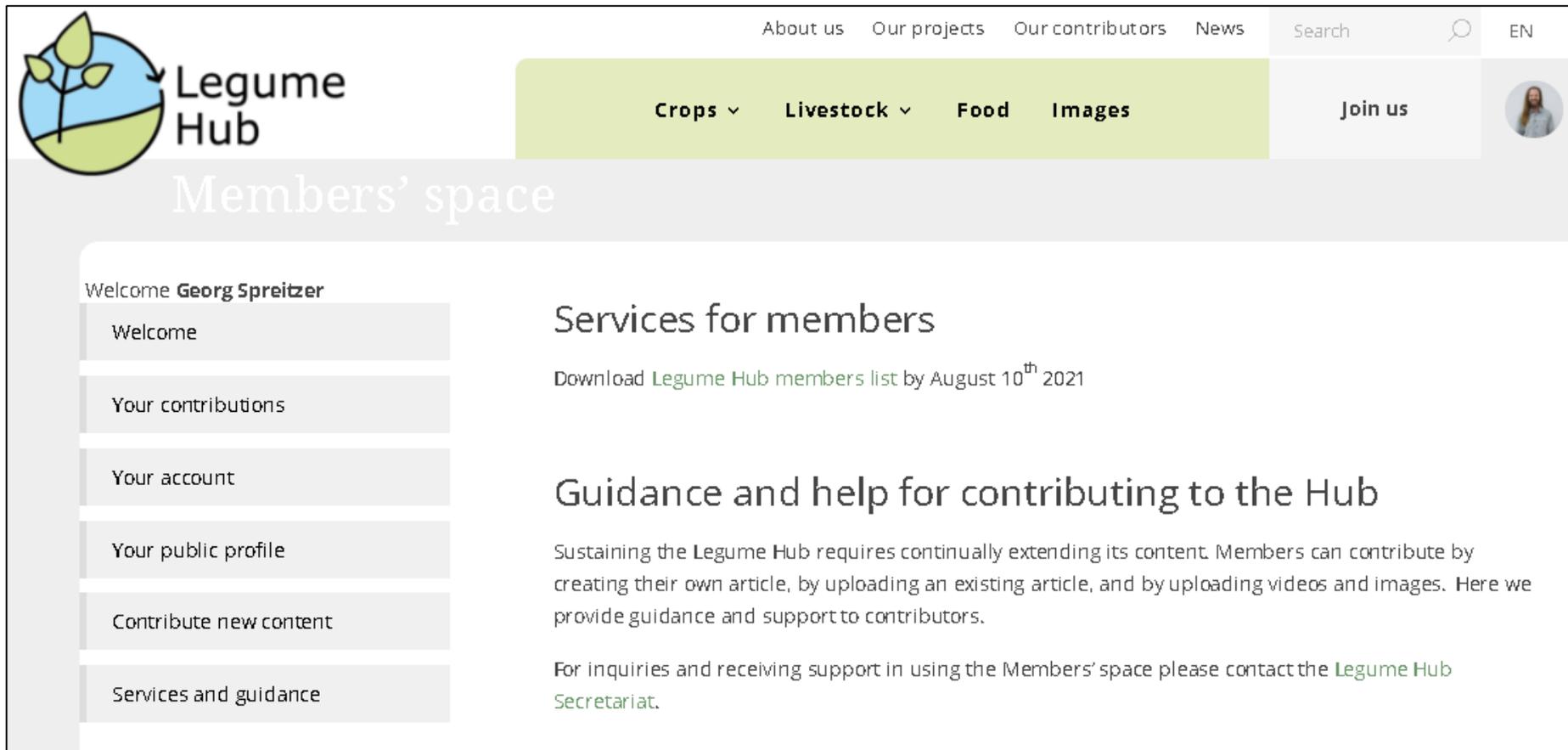
Use at least 8 characters including special characters to meet minimum security requirements.

Confirm password *

Use at least 8 characters including special characters to meet minimum security requirements.



Members' space



The screenshot shows the 'Members' space' page on the Legume Hub website. At the top left is the Legume Hub logo, which consists of a stylized plant with three green leaves and a blue stem, set against a circular background divided into blue and green sections. To the right of the logo, the text 'Legume Hub' is displayed. The top navigation bar includes links for 'About us', 'Our projects', 'Our contributors', and 'News'. A search bar with a magnifying glass icon and the text 'Search' is located to the right of these links. Further right, there is a language selector showing 'EN' and a profile picture of a woman. Below the navigation bar, a green horizontal bar contains the main menu items: 'Crops', 'Livestock', 'Food', and 'Images'. The main heading 'Members' space' is prominently displayed in a large, light-colored font. On the left side, there is a vertical sidebar with a list of menu items: 'Welcome Georg Spreitzer', 'Welcome', 'Your contributions', 'Your account', 'Your public profile', 'Contribute new content', and 'Services and guidance'. The main content area on the right features the heading 'Services for members' followed by a link to 'Download Legume Hub members list by August 10th 2021'. Below this is another heading, 'Guidance and help for contributing to the Hub', followed by a paragraph explaining that sustaining the Legume Hub requires continually extending its content and that members can contribute by creating or uploading articles, videos, and images. A final paragraph provides contact information for the Legume Hub Secretariat.

Legume Hub

About us Our projects Our contributors News Search EN

Crops Livestock Food Images

Join us

Members' space

Welcome **Georg Spreitzer**

- Welcome
- Your contributions
- Your account
- Your public profile
- Contribute new content
- Services and guidance

Services for members

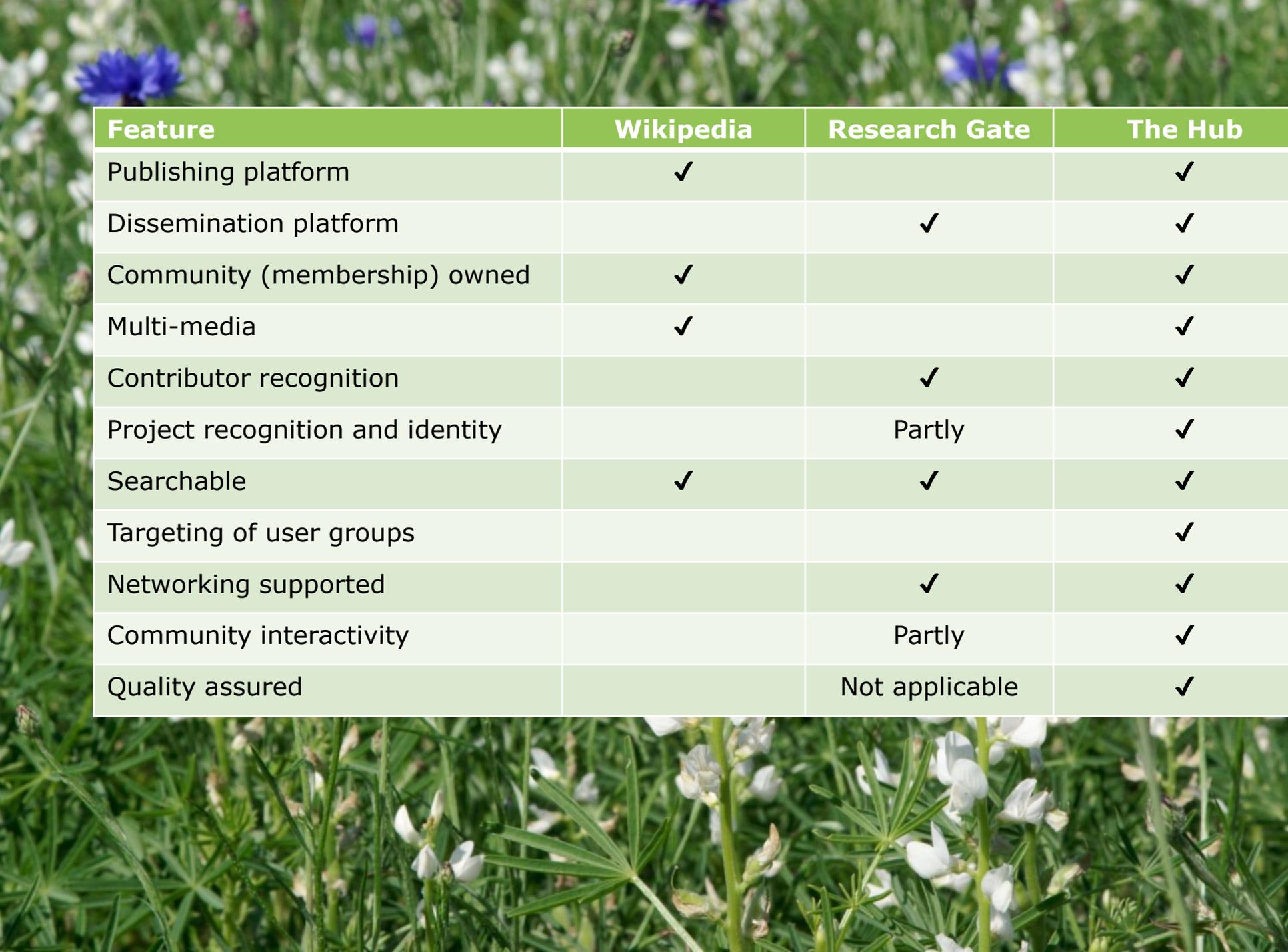
Download [Legume Hub members list](#) by August 10th 2021

Guidance and help for contributing to the Hub

Sustaining the Legume Hub requires continually extending its content. Members can contribute by creating their own article, by uploading an existing article, and by uploading videos and images. Here we provide guidance and support to contributors.

For inquiries and receiving support in using the Members' space please contact the [Legume Hub Secretariat](#).





Feature	Wikipedia	Research Gate	The Hub
Publishing platform	✓		✓
Dissemination platform		✓	✓
Community (membership) owned	✓		✓
Multi-media	✓		✓
Contributor recognition		✓	✓
Project recognition and identity		Partly	✓
Searchable	✓	✓	✓
Targeting of user groups			✓
Networking supported		✓	✓
Community interactivity		Partly	✓
Quality assured		Not applicable	✓

Structure of members

Members of the Legume Hub community	
Total number	56
Countries	16

Members per country	
Germany	21
United Kingdom	6
Serbia	5
Austria	4
Switzerland	4
Greece	3
Ireland	3
Bulgaria	2
Bosnia & Herzegovina	1
Croatia	1
Denmark	1
Finland	1
France	1
Italy	1
Mexico	1
Slovenia	1

How important are following legume crops in your work?	
Pea	3.6
Soybean	3.5
Faba bean	3.2
Lupin	2.7
Lucerne	2.6
Other: chickpea, lentil	
Average of all responses	

Your work	
Research & innovation	18
Non-government organisations	7
Education	6
Farming	5
Policy	2
Knowledge exchange	1
Food industry	1
Plant breeding	1
Multiple answers possible, in total 41 answers by 23 members	

Sustaining the Legume Hub

New consortia consider The Hub as a neutral community-owned publication platform

Ordinary publication and dissemination is covered by contributors' own project time

Fee-based access for consortia that undertake to use The Hub in their project plans

Participation of leading members of The Hub Association (e.g. DS) in consortia

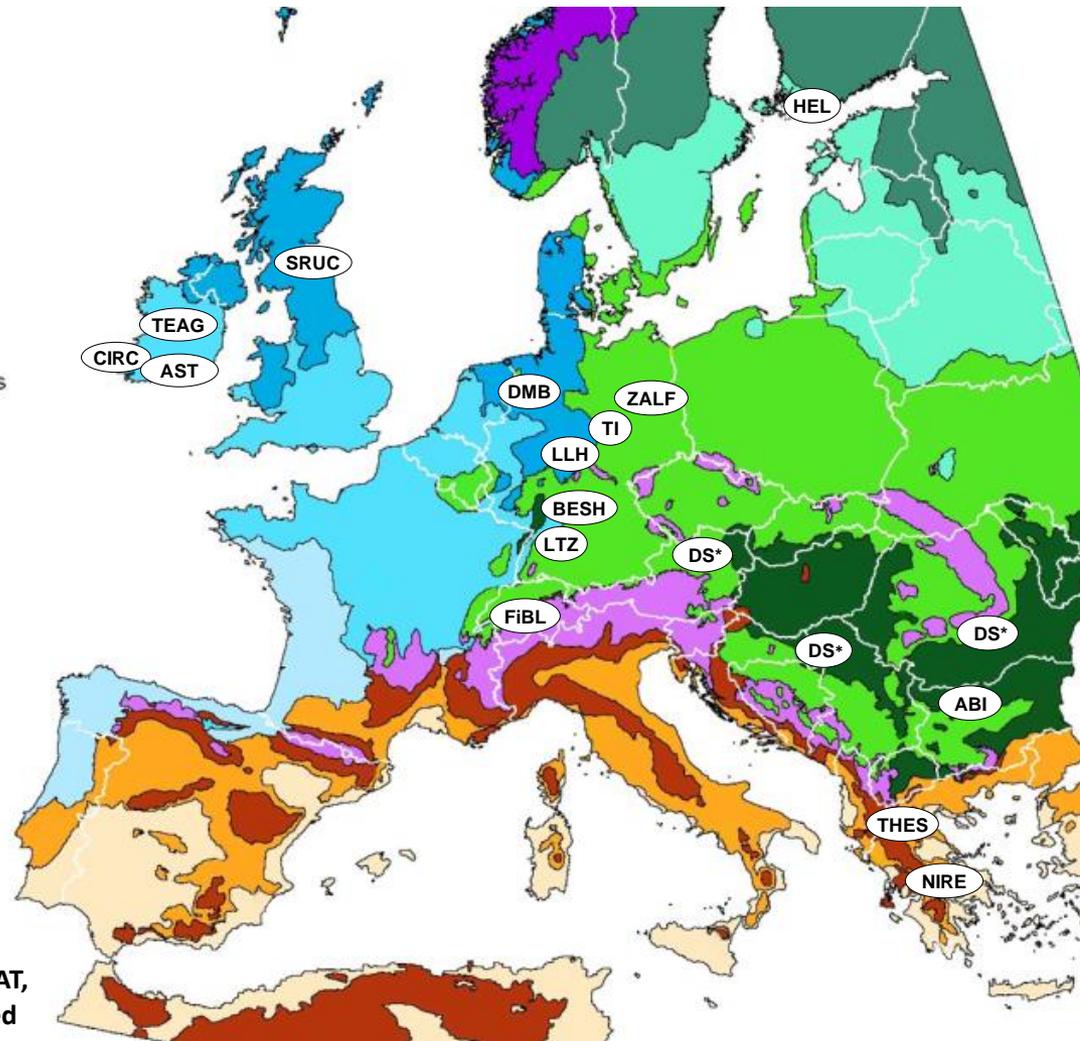
Registration of the Association



The consortium

Environmental Zone

- ALN - Alpine North
- BOR - Boreal
- NEM - Nemoral
- ATN - Atlantic North
- ALS - Alpine South
- CON - Continental
- ATC - Atlantic Central
- PAN - Pannonian
- LUS - Lusitanian
- ANA - Anotolian
- MDM - Mediteranean Mountains
- MDN - Mediteranean North
- MDS - Mediteranean South



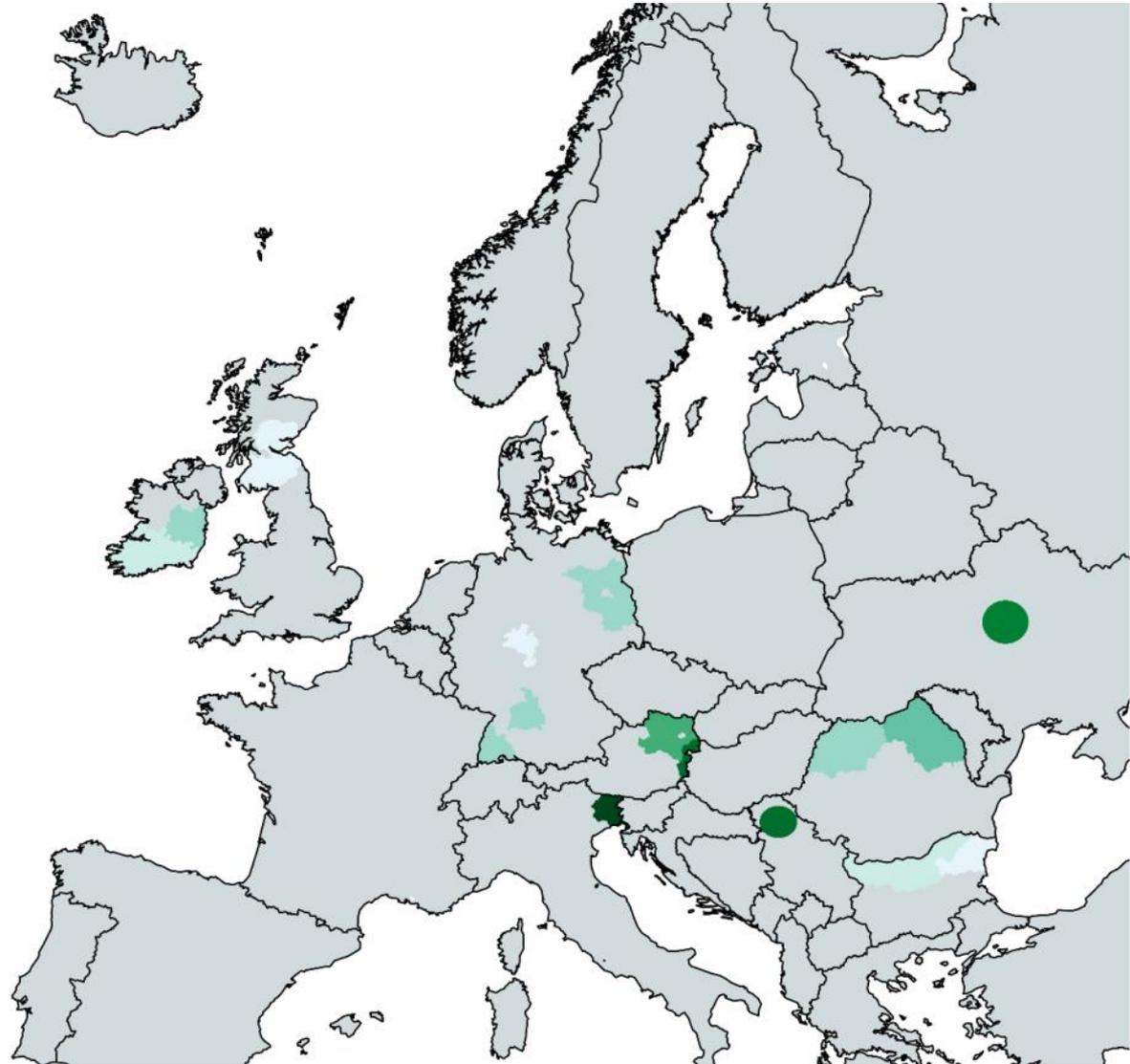
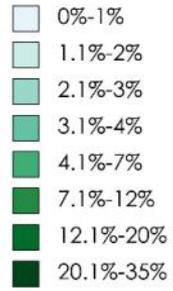
In context of this project, Danube Soya (DS) is particularly active in AT, SRB and RO and the map is marked accordingly with the locations of three DS offices.



Multi-criteria economic and environmental assessment

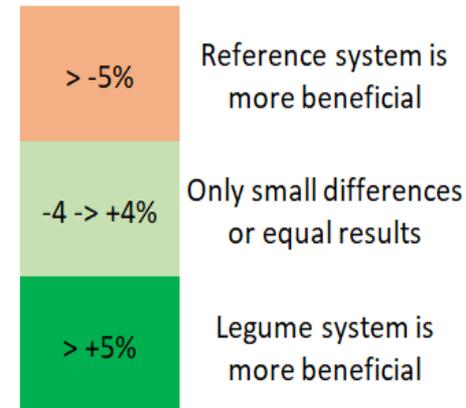


Study areas



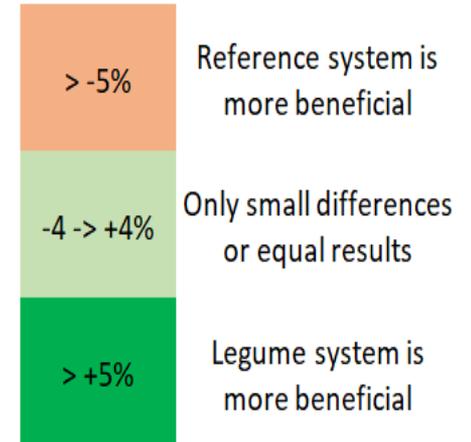
Economic indicators

Study area; reference rotation	Rotation with legume	GM (standard)	GM (feed value)	GM (subsidies)	GM (CO ₂ ,tax)
Central-eastern Europe					
BG, BG 31; WW-GM-SF	FP-WW-GM-SF	--	--	--	--
	WW-SF-FP-GM	--	+/-	--	--
BG, BG 32; WOR-WW-SF-GM	SY-WW-SF-WW	+/-	--	+/-	+/-
BG, BG 33; WOR-WW-SF-GM	CB-WW-SF-WW	--	--	--	--
RO, RO 11; GM-W	GM-WW-SY	+/-	--	++	+/-
RO, RO 21; GM-SF-WW	GM-WW-SY	++	--	++	++
RS, RS 12; GM-WW	GM-WW-SY	++	--	--	++
UA, Kyiv oblast; GM-SF-WW	GM-SY-SF-WW	++	--	--	++
Central-western Europe					
AT, AT 11; GM-GM-WW	SY-WW-GM	++	--	--	++
AT, AT 12; GM-WW-SF	GM-WW-SY	++	--	--	++
DE, DE 11; WW-WB-TR	WW-WB-FP-TR	--	+/-	++	--
DE, DE 11; SU-WW-WBGM	SU-WW-WB-FB	--	--	--	--
DE, DE 13 (Kies); GM-GM-WW-WOR	GM-GM-SY-WW-WOR	--	--	++	--
DE, DE 13 (Löss); GM-GM-WW-WOR	GM-GM-SY-WW-WOR	--	--	+/-	--
DE, DE 40 (soil type 2); WW-WB-WOR	WW-FP-WW-WB-WOR	--	--	--	--
	WW-SY-WW-WB-WOR	+/-	--	--	+/-
DE, DE 40 (soil type 3); WR-WR-WOR	WR-FP-WR-WOR	--	+/-	--	--
	WR-L-WR-WOR	--	--	--	--
DE, DE 73; WOR-WW-WW-SB	WOR-WW-FP-WW-SB	--	--	++	--
North-west Europe					
GB, UKM 7; WOR-WB-WO-SB-WB	WOR-WB-WO-FP-WB	+/-	+/-	--	+/-
	WOR-WB-WO-FB-SB	+/-	++	--	+/-
IE, IE 05, IE, 06; WB-WO-WW-WB-WOR-WW	WB-WO-WW-FB-WW	--	++	+/-	--
IE, IE 05, IE, 06; SMB-SO-SFB-SMB-SMB	SMB-FB-SO-SFB-SMB	++	++	++	++
Southern Europe					
IT, ITH 4; GM-GM-GM	GM-SY	++	--	++	++



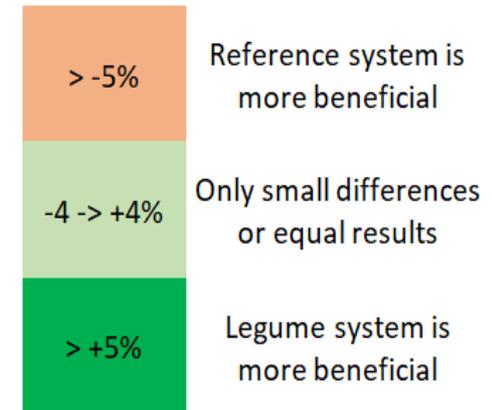
Environmental indicators

Study area; reference rotation	Rotation with legume	N fertilizer use	N ₂ O emissions	NO ₃ -N	Crop diversity
Central-eastern Europe					
BG, BG 31; WW-GM-SF	FP-WW-GM-SF	++	++	++	++
	WW-SF-FP-GM	++	++	++	++
BG, BG 32; WOR-WW-SF-GM	SY-WW-SF-WW	++	++	++	++
BG, BG 33; WOR-WW-SF-GM	CB-WW-SF-WW	++	+/-	--	++
RO, RO 11; GM-W	GM-WW-SY	++	++	++	++
RO, RO 21; GM-SF-WW	GM-WW-SY	+/-	--	--	+/-
RS, RS 12; GM-WW	GM-WW-SY	++	++	++	++
UA, Kyiv oblast; GM-SF-WW	GM-SY-SF-WW	++	++	--	++
Central-western Europe					
AT, AT 11; GM-GM-WW	SY-WW-GM	++	++	+/-	++
AT, AT 12; GM-WW-SF	GM-WW-SY	++	++	--	+/-
DE, DE 11; WW-WB-TR	WW-WB-FP-TR	++	++	++	++
DE, DE 11; SU-WW-WBGM	SU-WW-WB-FB	++	++	--	++
DE, DE 13 (Kies); GM-GM-WW-WOR	GM-GM-SY-WW-WOR	++	++	+/-	++
DE, DE 13 (Löss); GM-GM-WW-WOR	GM-GM-SY-WW-WOR	++	++	+/-	++
DE, DE 40 (soil type 2); WW-WB-WOR	WW-FP-WW-WB-WOR	++	++	++	++
	WW-SY-WW-WB-WOR	++	++	++	++
DE, DE 40 (soil type 3); WR-WR-WOR	WR-FP-WR-WOR	++	++	++	++
	WR-L-WR-WOR	++	++	++	++
DE, DE 73; WOR-WW-WW-SB	WOR-WW-FP-WW-SB	++	++	++	++
North-western Europe					
GB, UKM 7; WOR-WB-WO-SB-WB	WOR-WB-WO-FP-WB	++	++	++	++
	WOR-WB-WO-FB-SB	++	++	++	++
IE, IE 05, IE, 06; WB-WO-WW-WB-WOR-WW	WB-WO-WW-FB-WW	++	++	++	+/-
IE, IE 05, IE, 06; SMB-SO-SFB-SMB-SMB	SMB-FB-SO-SFB-SMB	++	++	++	++
Southern Europe					
IT, ITH 4; GM-GM-GM	GM-SY	++	++	++	++



Production indicators

Study area; reference rotation	Rotation with legume	Yield stability	Protein output	Energy output
Central-eastern Europe				
BG, BG 31; WW-GM-SF	FP-WW-GM-SF	+/-	+/-	--
	WW-SF-FP-GM	+/-	+/-	--
BG, BG 32; WOR-WW-SF-GM	SY-WW-SF-WW	--	+/-	--
BG, BG 33; WOR-WW-SF-GM	CB-WW-SF-WW	--	--	--
RO, RO 11; GM-W	GM-WW-SY	+/-	++	--
RO, RO 21; GM-SF-WW	GM-WW-SY	+/-	++	++
RS, RS 12; GM-WW	GM-WW-SY	+/-	++	++
UA, Kyiv oblast; GM-SF-WW	GM-SY-SF-WW	+/-	++	--
Central-west Europe				
AT, AT 11; GM-GM-WW	SY-WW-GM	--	++	--
AT, AT 12; GM-WW-SF	GM-WW-SY	+/-	++	+/-
DE, DE 11; WW-WB-TR	WW-WB-FP-TR	+/-	+/-	--
DE, DE 11; SU-WW-WBGM	SU-WW-WB-FB	+/-	+/-	--
DE, DE 13 (Kies); GM-GM-WW-WOR	GM-GM-SY-WW-WOR	+/-	++	--
DE, DE 13 (Löss); GM-GM-WW-WOR	GM-GM-SY-WW-WOR	+/-	++	--
DE, DE 40 (soil type 2); WW-WB-WOR	WW-FP-WW-WB-WOR	+/-	+/-	--
	WW-SY-WW-WB-WOR	+/-	++	--
DE, DE 40 (soil type 3); WR-WR-WOR	WR-FP-WR-WOR	+/-	++	--
	WR-L-WR-WOR	--	++	--
DE, DE 73; WOR-WW-WW-SB	WOR-WW-FP-WW-SB	+/-	++	--
North-west Europe				
GB, UKM 7; WOR-WB-WO-SB-WB	WOR-WB-WO-FP-WB	+/-	++	+/-
	WOR-WB-WO-FB-SB	+/-	++	--
IE, IE 05, IE, 06; WB-WO-WW-WB-WOR-WW	WB-WO-WW-FB-WW	+/-	++	+/-
IE, IE 05, IE, 06; SMB-SO-SFB-SMB-SMB	SMB-FB-SO-SFB-SMB	+/-	++	+/-
Southern Europe				
IT, ITH 4; GM-GM-GM	GM-SY	+/-	++	--



Assessing opportunities and constraints using the Delphi method



What is the group's understanding?

What is the group answer to a particular question

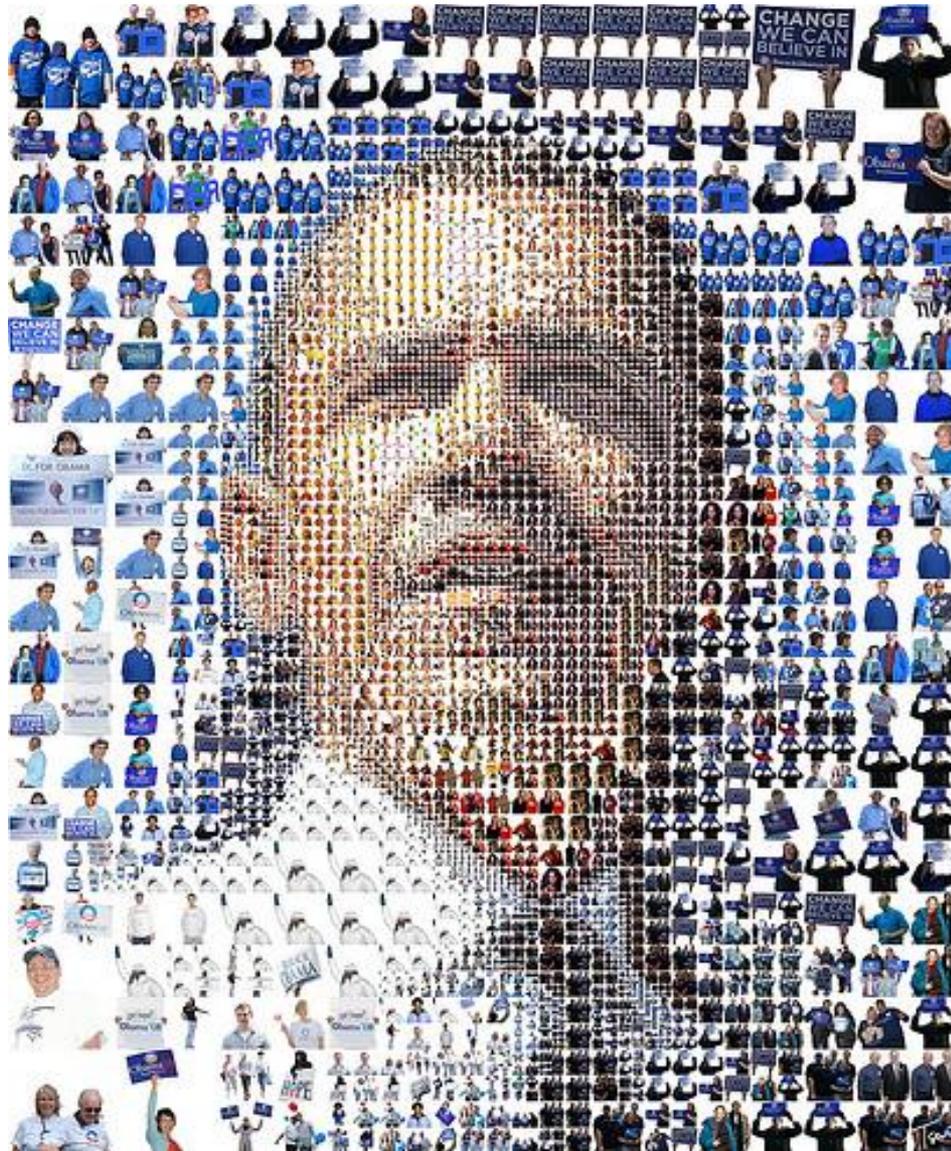
Prediction based on expert insight rather than data

Urgent questions

Face-to-face focus groups?

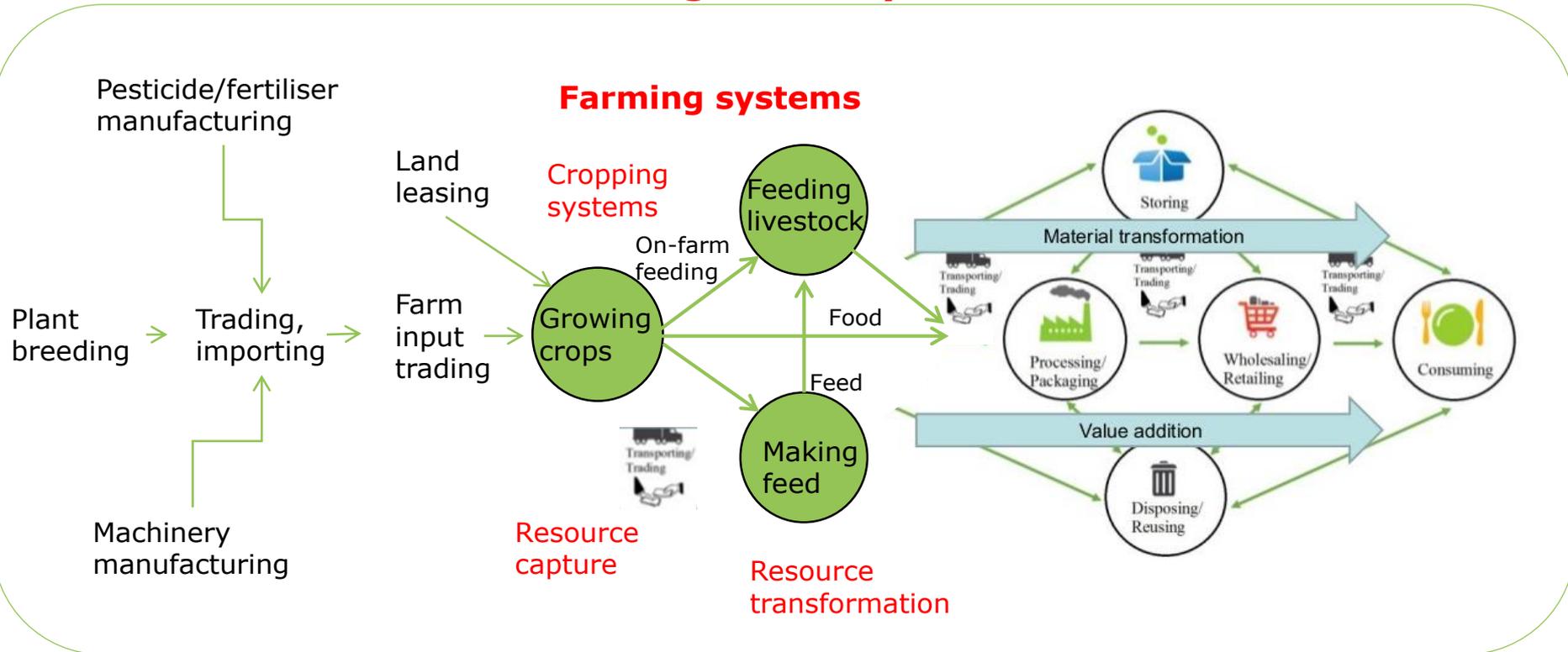


Can we see a pattern?



Value chains: lots of actors do "ing" things:
producing, processing, storing, retailing, and trading

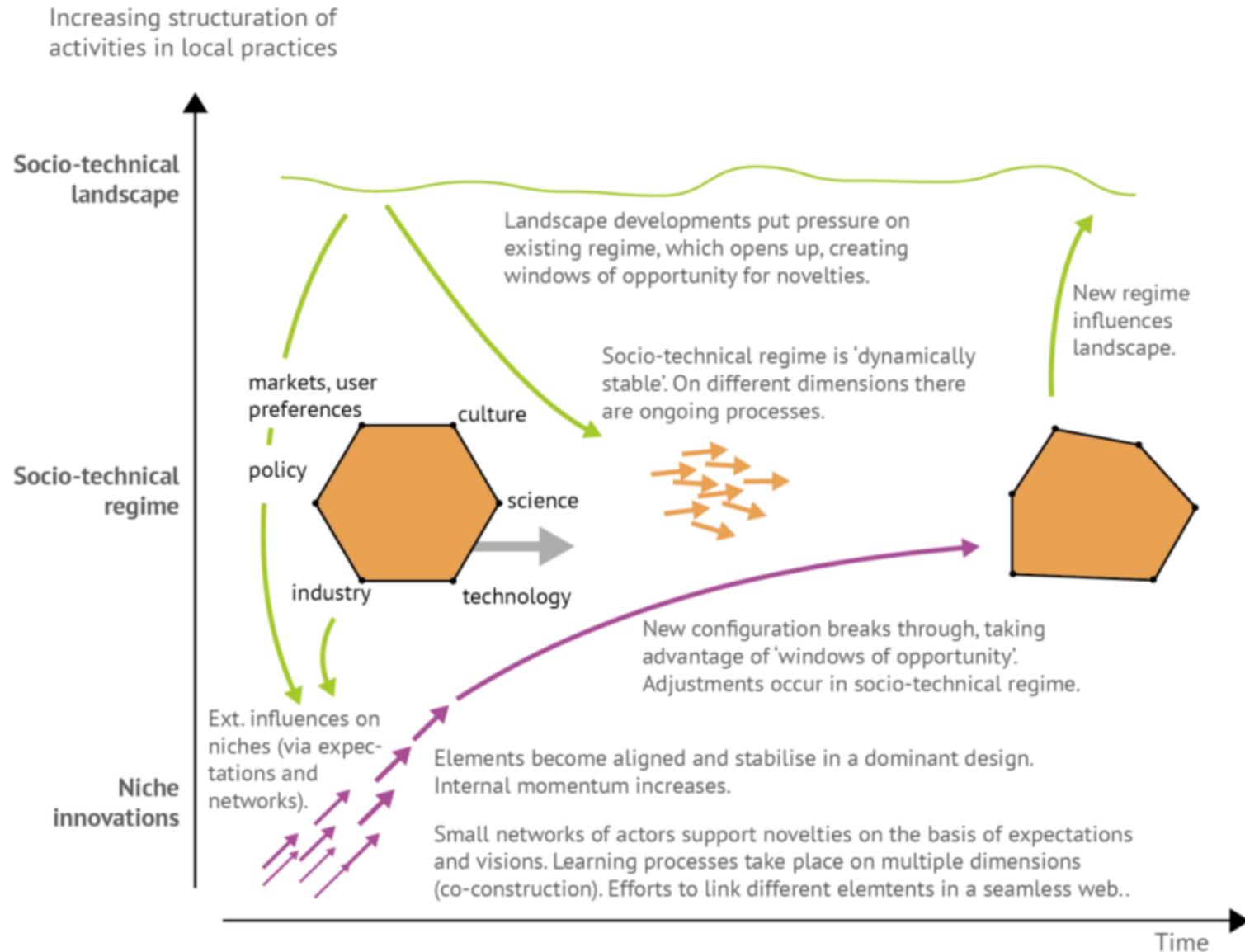
Agri-food systems



Regulating or supporting (policy)

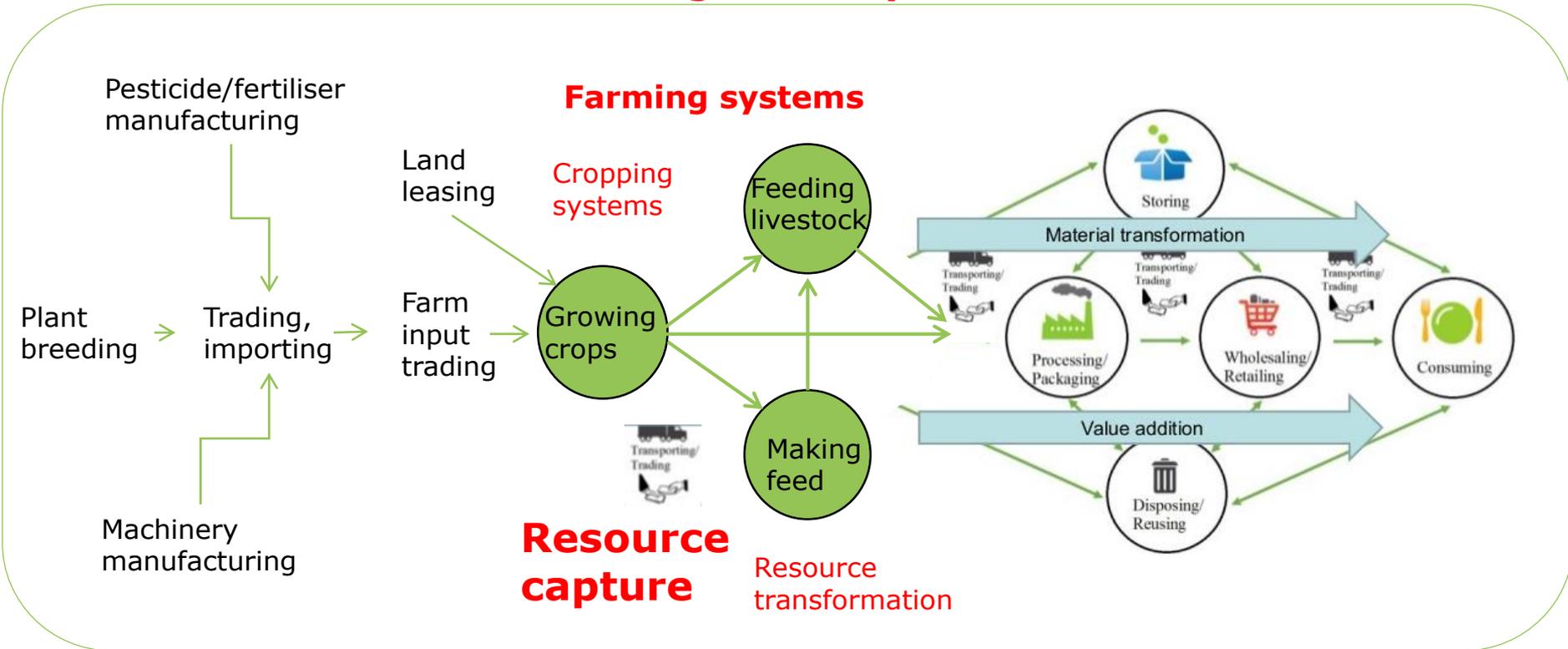
Adapted from John Ingram, University of Oxford
<https://www.youtube.com/watch?v=jFunLO10-DU>

Transition theory (Geels, 2011)



Value chains: producing, processing, storing, retailing, and trading

Agri-food systems



Regulating or supporting (policy)

Adapted from John Ingram, University of Oxford
<https://www.youtube.com/watch?v=jFunLO10-DU>



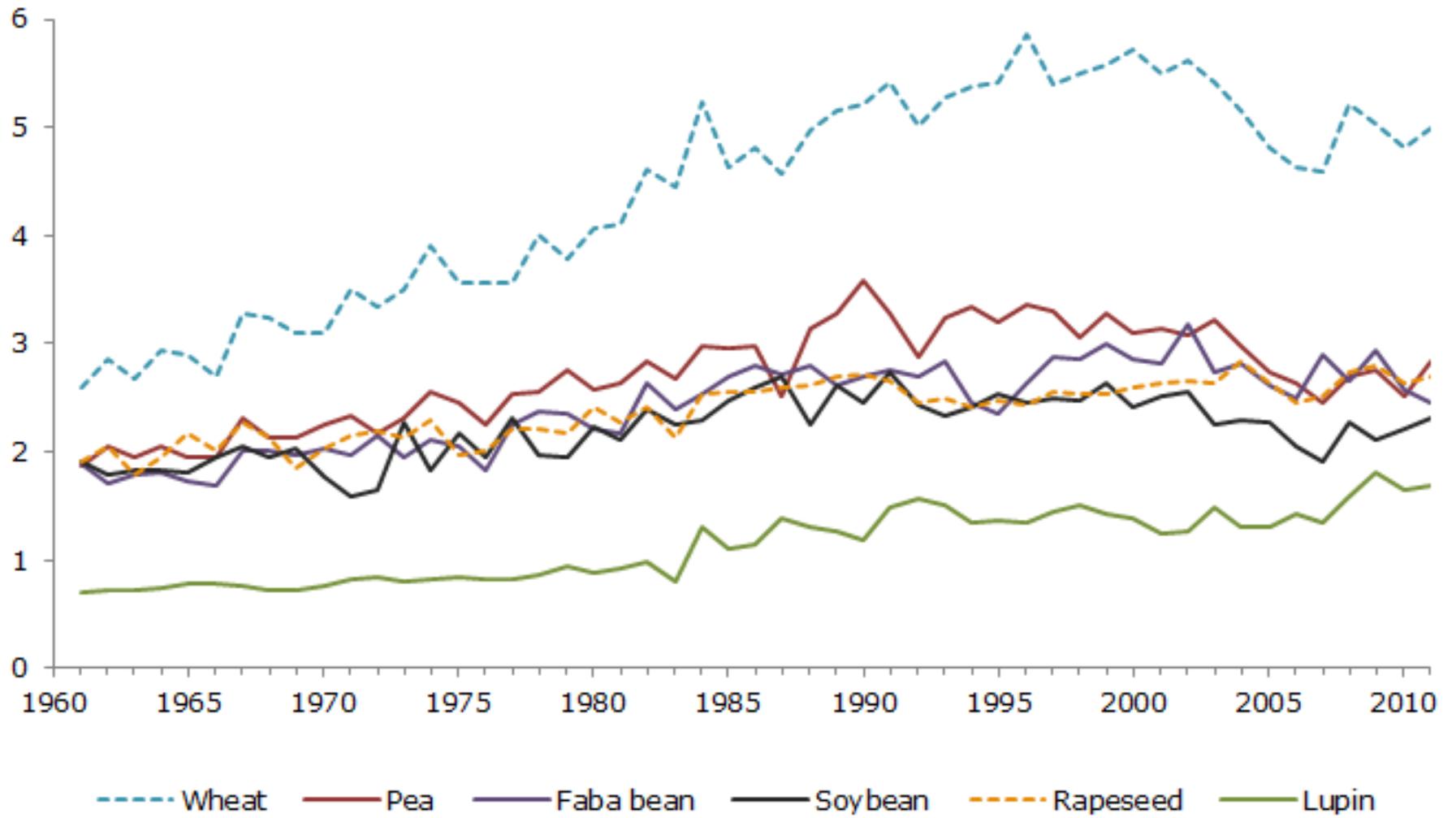








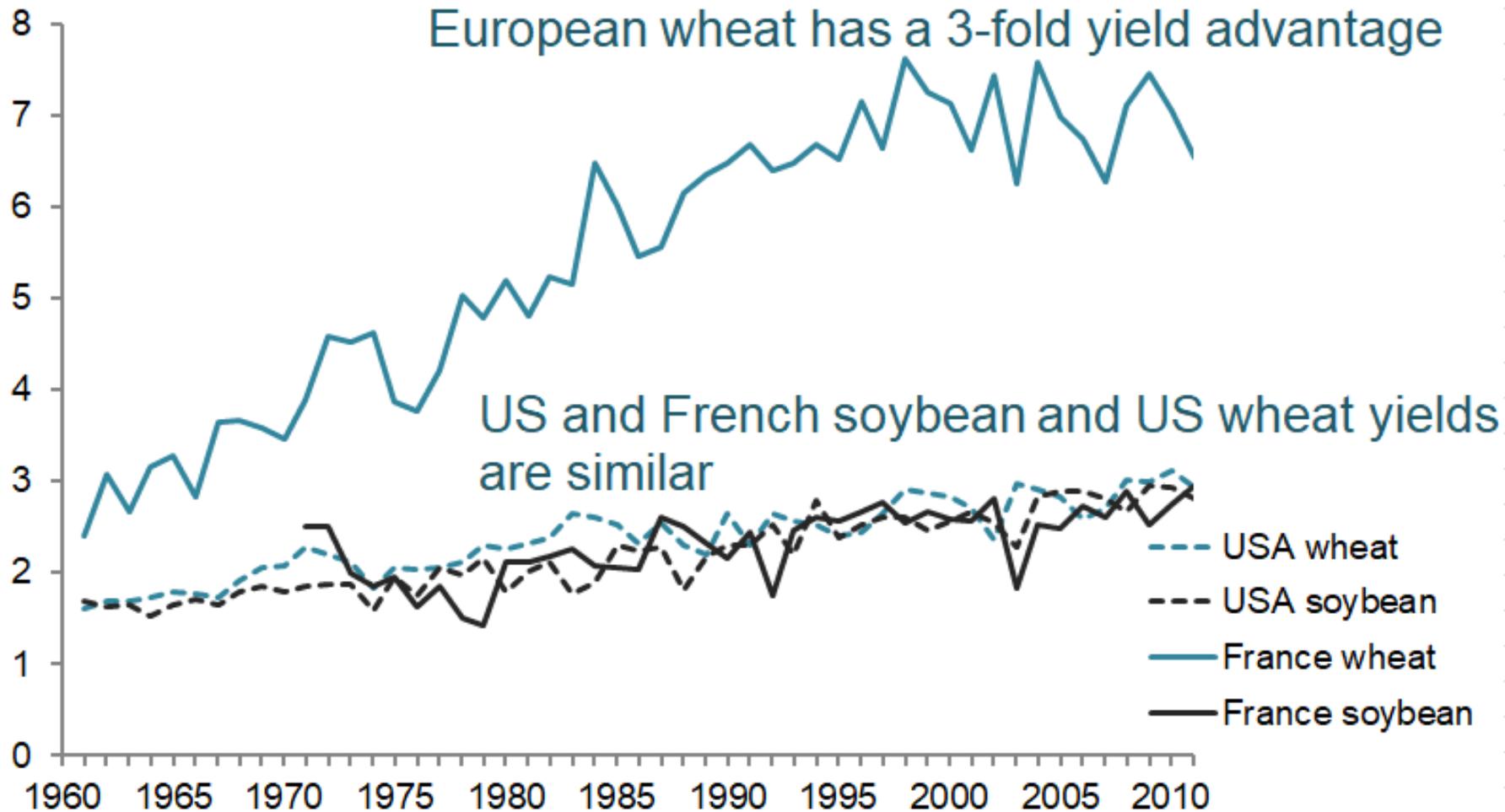
Yield (t/ha)



Yield (t/ha)

European wheat has a 3-fold yield advantage

US and French soybean and US wheat yields are similar



Endnote

Increasing the role of European-grown legumes in agri-food value chains amounts to a **de-intensification of our agri-food systems**.

The current European agri-food system is enabled by the combination of specialisation in intensively fertilised carbohydrate-rich crops complemented by the import of about 16 million tonnes of plant protein into the EU each year. Developing legumes is one component of a wider change process that will align how we consume and produce food meeting long-term global and European environmental goals. This change can be monitored in protein and nitrogen balances.



“How we eat determines, to a considerable extent, how the world is used”

Wendell Berry





Legumes Translated (Translating knowledge for legume-based farming for feed and food systems) has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817634

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