

Research challenges for protein crops



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*“Personal” opinions
to boost discussion*

Brussels 24 April 2018

Legumes are multifunctional crops with extraordinary importance for the agriculture, environment and culture

key role in animal feed

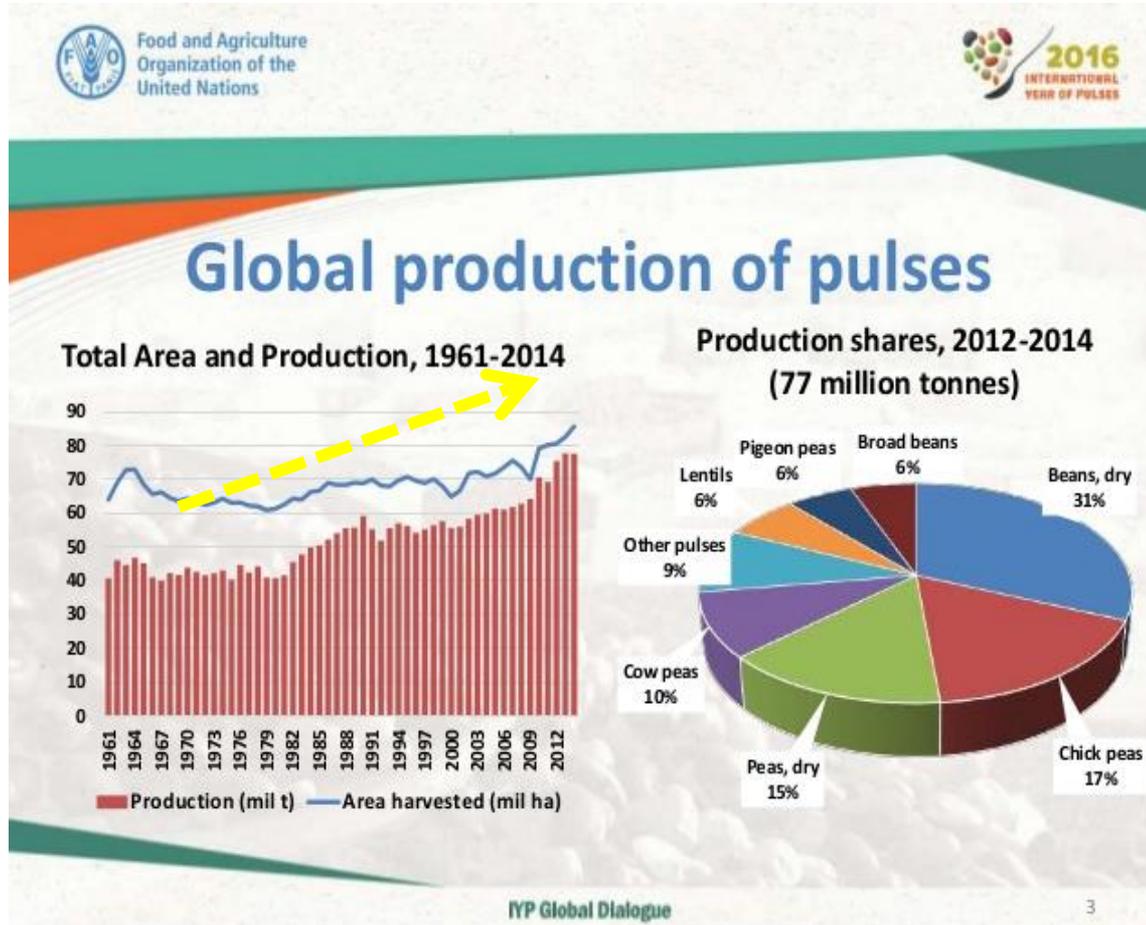


key role in healthy human diets



key for sustainable agriculture and environment

There is an increasing trend at world level



Perspectives for further growth as word demand will increase

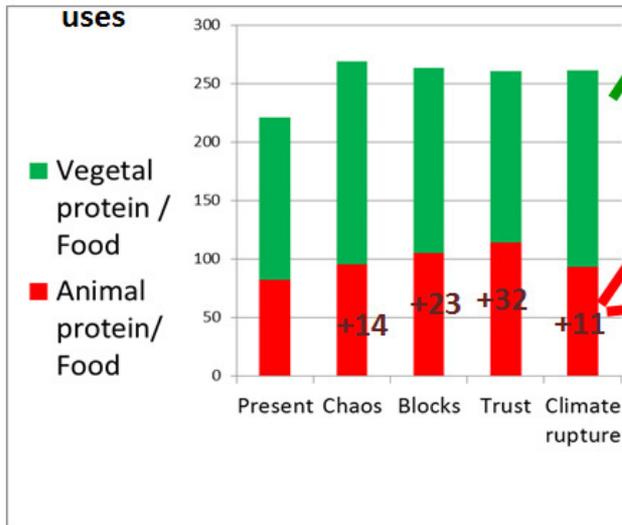
(Pilorge & Muel, 2016)

World demand for proteins (MT)

Depending on:

- Population growth
- Food habits

Protein food uses



Perspectives for further growth:

Models suggest that legumes will be more important by 2030

(Pilorge & Muel, 2016)

Expectations for 2030	Escenario Chaos	Escenario Blocs	Escenario Confiance	Escenario Rupture Climatic
	Word			
Colza	-	++	+	-
Sunflower	-	+	+	-
Soja	++	+++	++	++
Grain legumes	++	+++	++	+

Upcoming Publication



TEN-YEAR PULSE RESEARCH STRATEGY

The Ten-Year Research Strategy report will be used to set an agenda for global discussion and mobilize champions to advocate for accelerated pulse research investments.

Organizing Author

Dr. Shoba Sivasankar, Director, CGIAR Research Program on Grain Legumes, ICRISAT

Lead Author – Breeding and genetics for improved productivity and resilience

Dr. Noel Ellis, ICRISAT (retired)

Lead Author – Pulses in integrated crop systems and agricultural landscapes

Dr. Robin Buruchara, Director of the Pan Africa Bean Research Alliance, CGIAR-CIAT

Lead Author – Integration of pulses into food systems

Dr. Carol Henry, Associate Professor of Nutrition and Diet, University of Saskatchewan

Coordinating Author

Dr. Christine Negra, Principal, Versant Vision

Lead Author – Integration across agricultural, nutritional and social sciences

Dr. Diego Rubiales, Professor, Spanish National Research Council, Institute for Sustainable Agriculture

Lead Author – Spatially-explicit analyses related to local and global challenges

Dr. Jeet Singh Sandhu, Deputy Director General, Indian Council of Agricultural Research, Division of Crop Science

The UN Food and Agriculture Organization has declared 2016 the International Year of Pulses (IYP) to encourage connections throughout the food chain that would better utilize pulse-based proteins, further global production of pulses, increase the efficiency of crop rotations, and address trade challenges. The International Year creates a unique moment to showcase transformative research investments that would allow pulse crops to deliver on their full potential as a critical player in the global food system.

With funding support by the International Development Research Council (IDRC) of Canada, this initiative is led by Emerging Ag, Inc. on behalf of the Global Pulse Confederation, which has sponsored a wide array of activities for the International Year of Pulses. It is motivated by the large gap between the potential of pulse crops for meeting global sustainability challenges and the current capacity to seize this potential.

Pulses receive globally <1% of resources for research

target: increase this to 10%

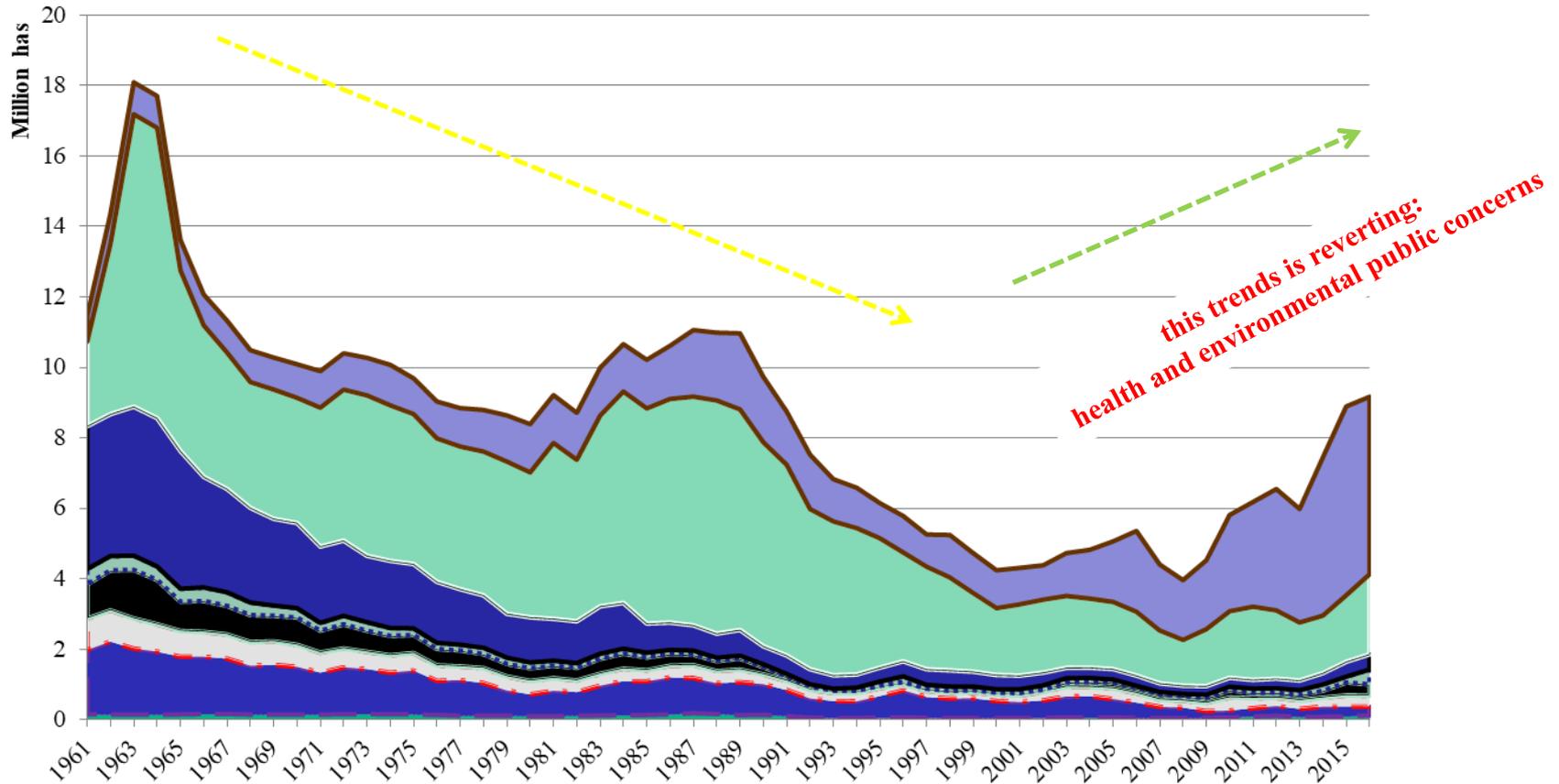


Even better perspectives for Europe!

(Pilorge & Muel, 2016)

Expectations for 2030	Escenario Chaos	Escenario Blocs	Escenario Con fiance	Escenario Rupture Climatic
Word				
Colza	-	++	+	-
Sunflower	-	+	+	-
Soja	++	+++	++	++
Grain legumes	++	+++	++	+
Europe				
Colza	-	-	=	--
Sunflower	-	--	-	--
Soja	+++	+++	++	+++
Grain legumes	+	+++	+++	+++

EUROPE

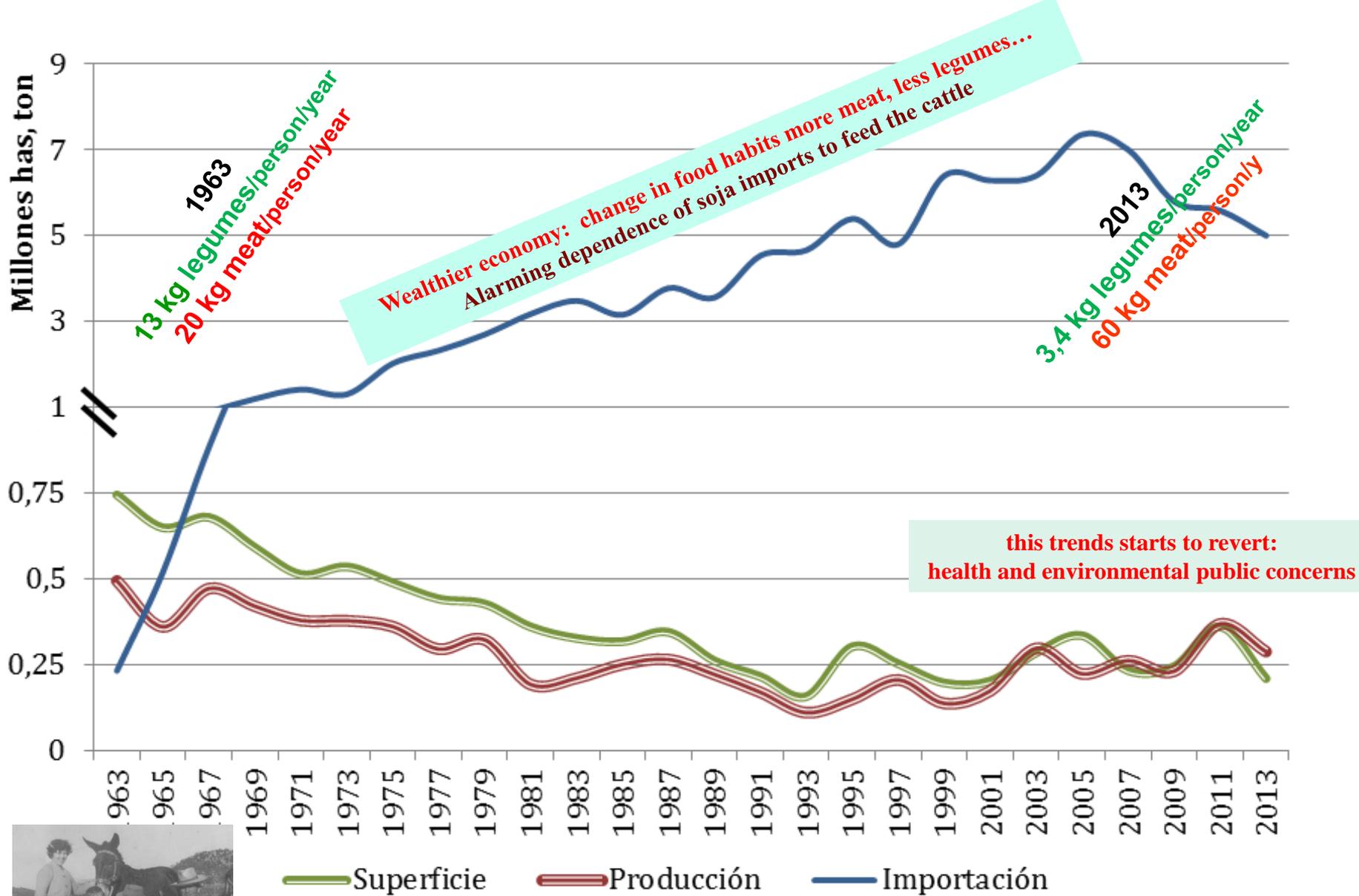


Historic trend in legume cultivation in Europe

What is wrong with legumes in EU ???

in spite of the good performance at global level

legume cultivation is decreasing at EU level



Historic trend: change in economy and agriculture

“wrong assumptions” hampering legumes image

Eating legumes is not ”cool”: **“the food of the poor”**

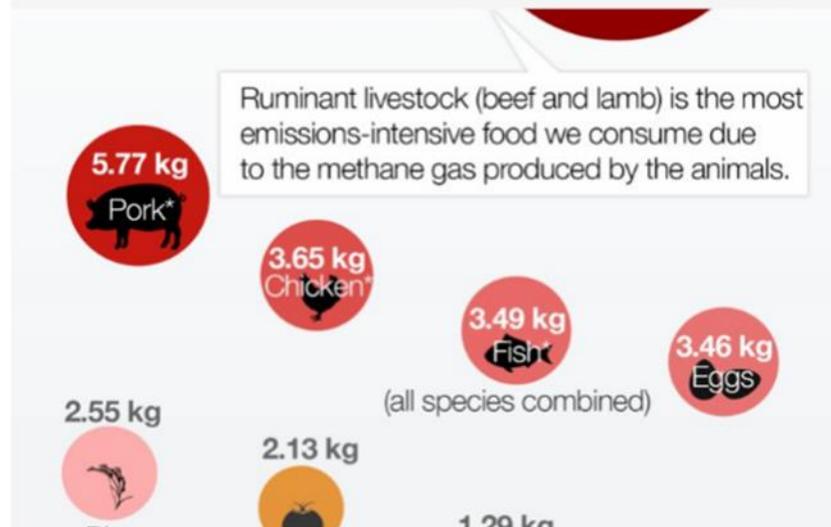
Shouldn't we say **“the food of the smart”**?



interesting.. Pulses is the future of food.. @CICILSIPTIC

World Economic Forum @wef

A new report says we should tax meat-eaters like smokers wef.ch/2Gs0fyC
#health



To produce **1 kg of cow meat**:

- Emission of **27 Kg CO2**
- **15.400 liters of water**
- **1 kg of protein requires 600 m²**

To produce **1 kg of lentils**:

- **< 1kg CO2,**
- **5.854 l of water**
- **1 kg protein 250 m²**

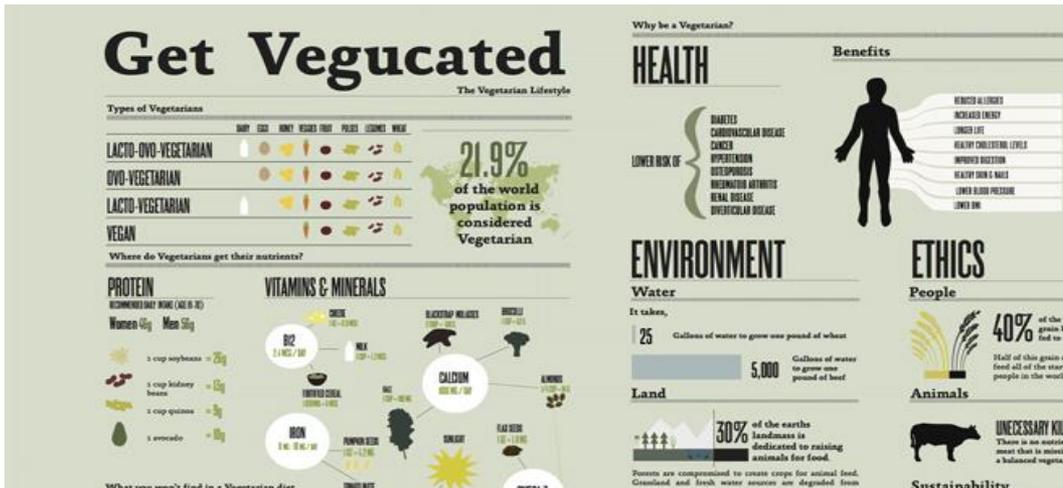
Legumes are cool!

“The Future of Food Is Plant-Based”

<https://t.co/v72w31jQrd>



“We're addicted to meat. And it's destroying the planet”



Pulses are the Future of Food.

Pulses are the future of sustainable food.

Pulses have a low carbon footprint.

Pulses are a water and fertilizer efficient crops.

Pulses enrich the soil where they grow.



Growing Pulses is good for our planet

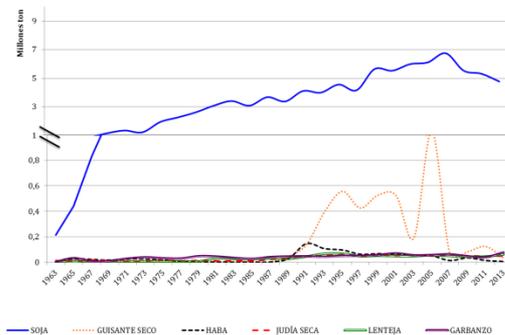
- **Decreased Greenhouse gas emissions**
- **Improved soil health**
- **Increased water efficiency**

Increasing consumption will solve the problem?

Consumption is today much lower than before,
STILL, we import about el 60 -85% of the food legumes that we eat in Spain!!!

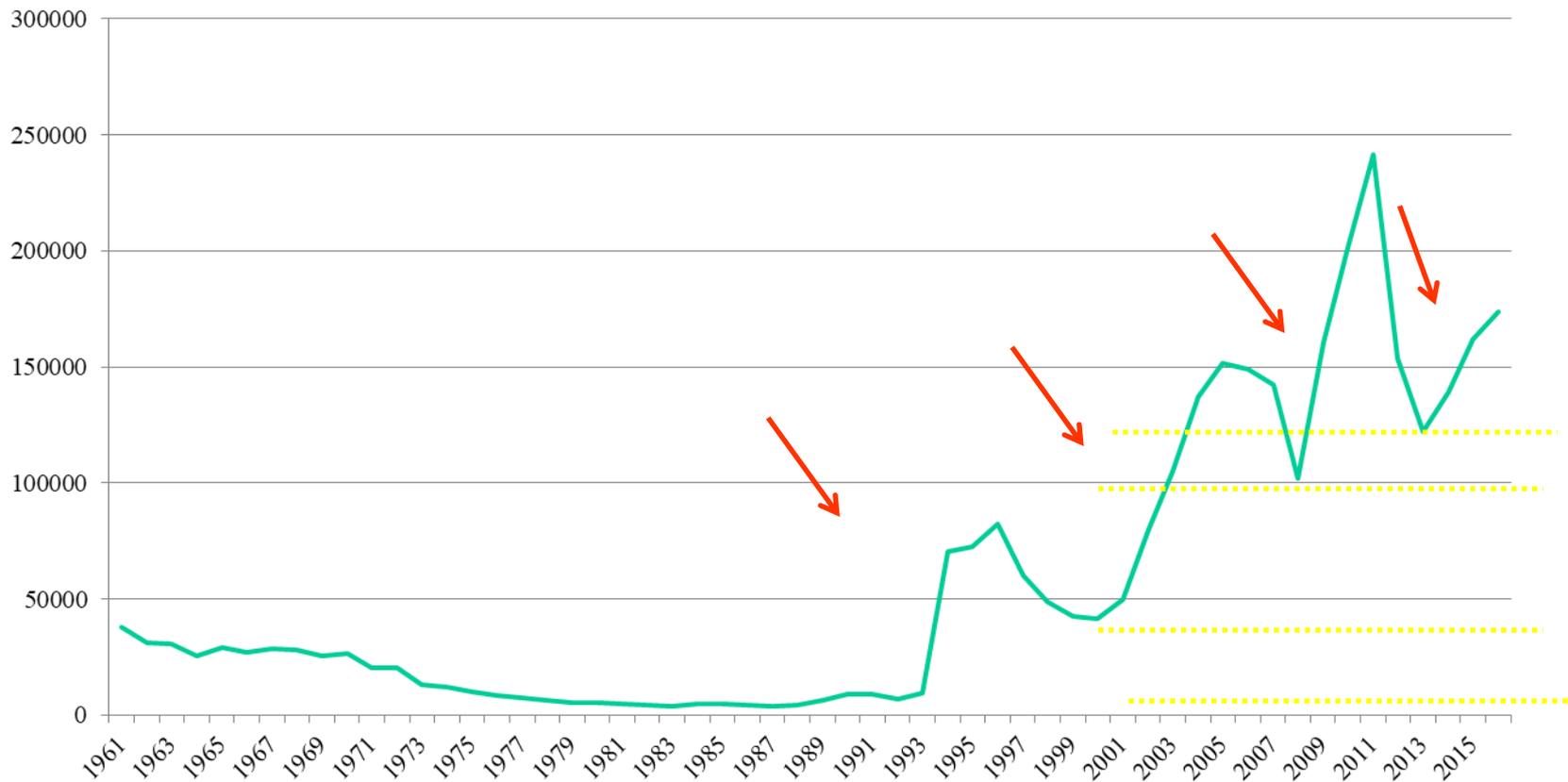
**By promoting consumption but not acting at the production level,
we would be just promoting imports!!!
What about ecological services? What about rural economies?**

Soya case study: the continuous increase in use for feed concentrates did not results in increase cultivation but on dramatic dependence on imports

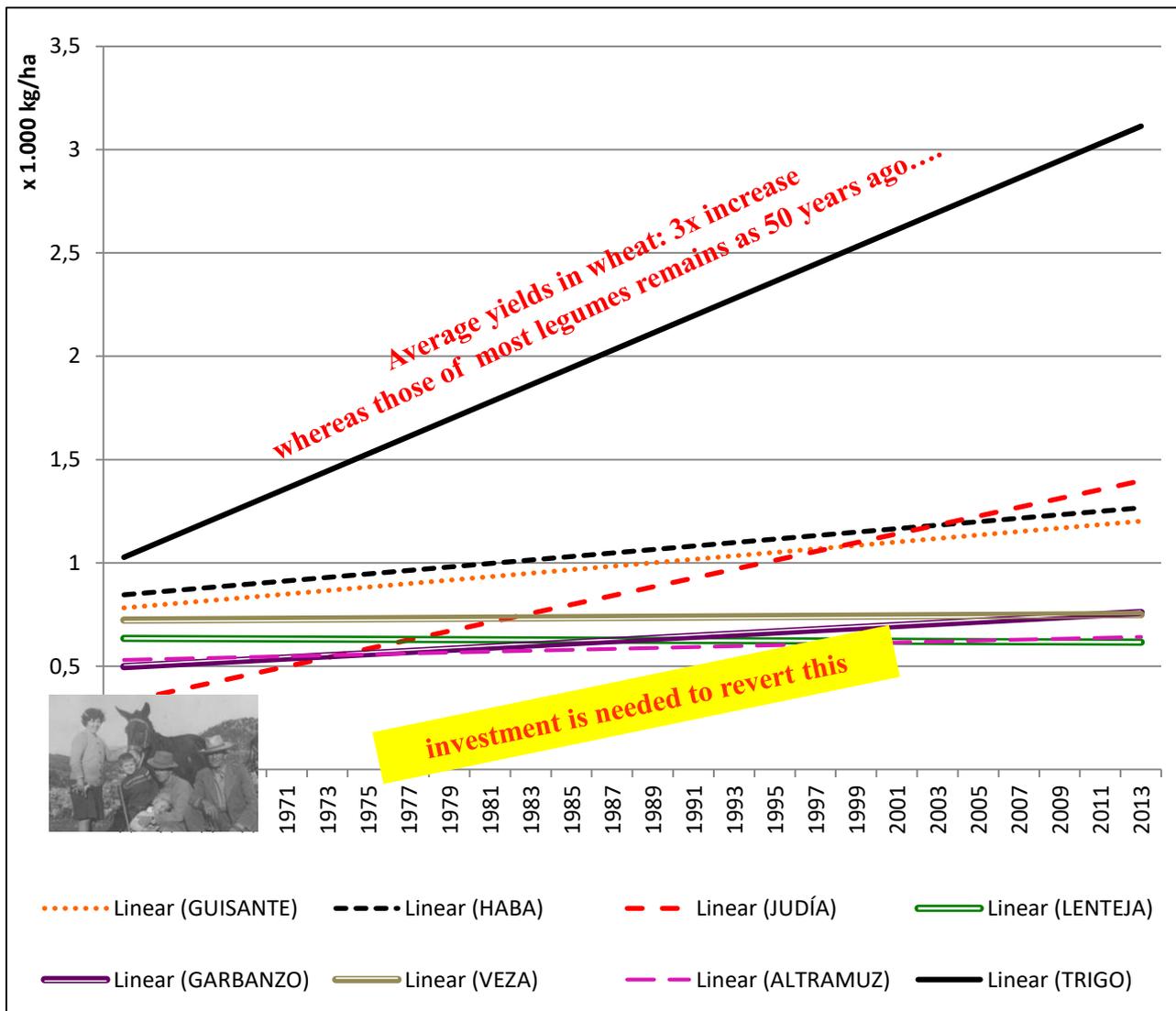


Subsidies?

dry pea in Spain



Legume investment has been neglected in benefit of other crops that have been better incorporated to “modern agriculture”:



Spain

Annual yield gain (Kg/ha/year)

Pea 8

Faba bean 9

Common bean 22

Lentil 0

Chickpea 5

Vetch 1

Lupin 2

Wheat 52

Major limitations for legume cultivation/breeding:

Relatively low **yield potential-stability**

Numerous species multiplying breeder's investments

Breeding priorities: genetic resources, proper phenotyping, selection (MAS)

- **Grower satisfaction:**

Good yield, disease resistance, lodging, herbicide tolerance, high prize

- **Consumer satisfaction**

colour, size, appearance, nutrition, low cost

GENETIC RESOURCES

Never enough... but great germbank collections available

	No. accessions in European genebanks
<i>Pisum</i>	30.455
<i>Lens</i>	9.260
<i>Vicia</i>	28.084
<i>Lathyrus</i>	6.791
<i>Cicer</i>	11.956
<i>Phaseolus</i>	52.179
<i>Glycine</i>	16.281
<i>Vigna</i>	6.437
<i>Arachis</i>	3.349
<i>Lupinus</i>	13.187
<i>Trifolium</i>	27.963
<i>Medicago</i>	16.744
<i>Onobrychis</i>	1.880
<i>Ornithopus</i>	1.197
<i>Lotus</i>	2.643

Fully available on request <https://eurisco.ipk-gatersleben.de/>

although probably insufficiently characterized for agronomic value or traits of interest

Genomic resources becoming available

LegumeInfo.org provides genome browsers for legumes with sequenced genomes.



A. duranensis
(wild peanut)



A. hypogaea
(cultivated peanut)



A. ipaensis
(wild peanut)



C. cajan
(pigeon pea)



C. arietinum
(desi & kabuli chickpea)



G. max
(soybean)



L. japonicus
(Lotus/bird's-foot trefoil)



L. angustifolius
(narrow leafed lupin)



M. truncatula
(Medicago / barrel medic)



P. vulgaris
(common bean)



T. pratense
(red clover)



V. angularis
(adzuki bean)

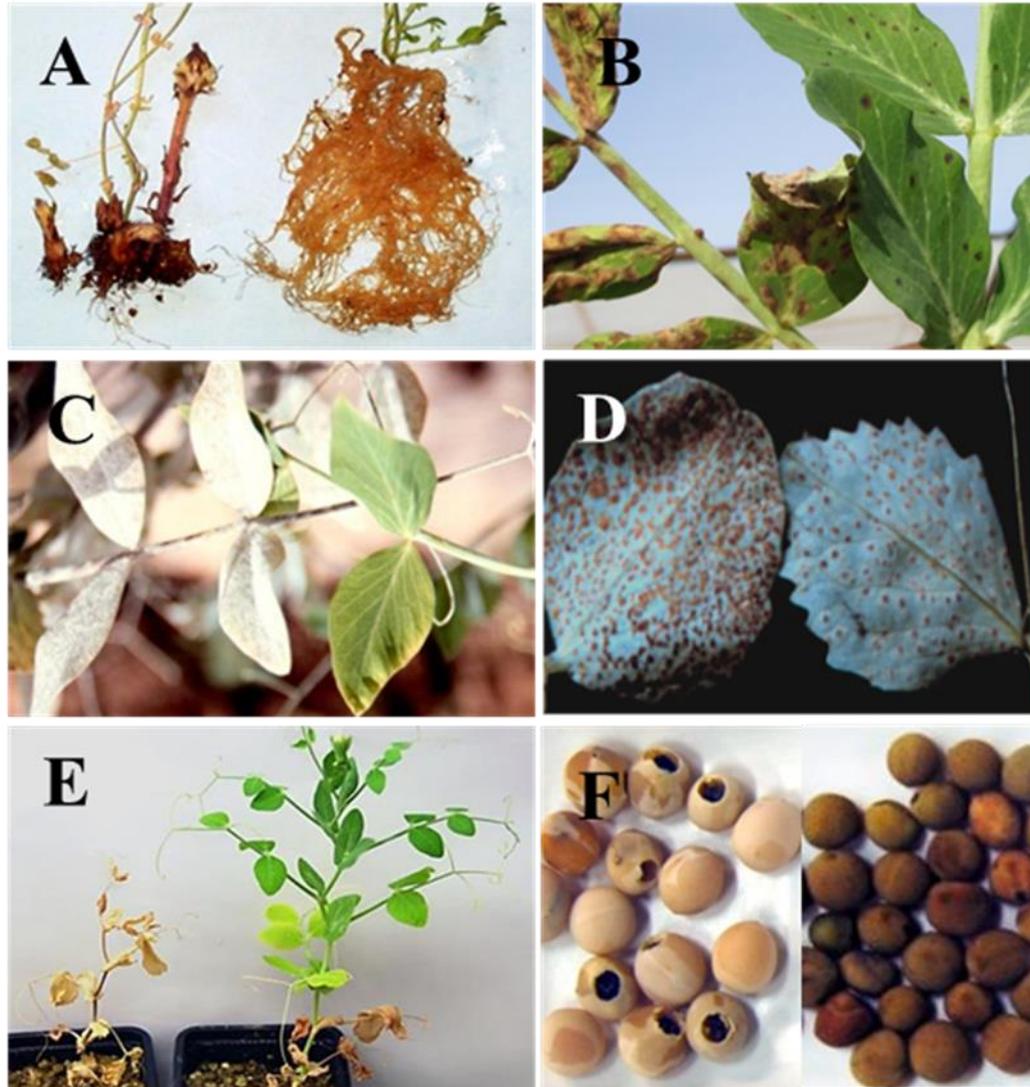


V. radiata
(mungbean)



V. unguiculata
(cowpea)

The good news: resistance to most biotic and abiotic stresses has been identified now in all legume crops.



The success histories of Australia and Canada

WA: almost a desert, poor soils

Saskatchewan: little growing season: snow from October till April

NO tradition of legume cultivation neither consumption!

Grain growers were interested in having a legume in the rotation to improve soil fertility and were able to get organized to start legume programs starting from zero...

Today, they are the larger producers and exporters

Pulse Canadá

GRDC- Pulse Australia

**Producers fund the research,
They establish the priorities and monitor the progress**



2.6k
Shares

Hollywood director James Cameron invests in Saskatchewan pea processing plant

Plant expected to be the largest organic pea protein facility in North America

The Canadian Press - Posted: Sep 18, 2017 11:54 AM CT | Last Updated: September 19, 2017



Saskatchewan Premier Brad Wall with James Cameron and Suzy Amis Cameron at the launch of the new plant in Vanscoy, Sask. (Don Somers/CBC News)

European Association for Grain Legumes Research



President
2008-2013



Vice-president

International Legume Society



President
2012-2016



Vice-president

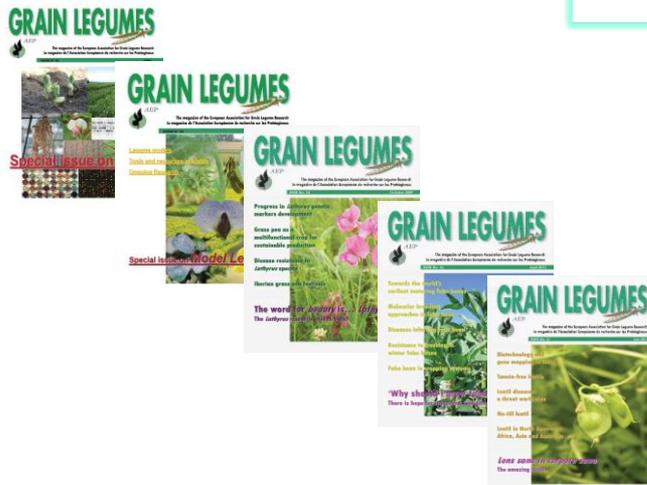
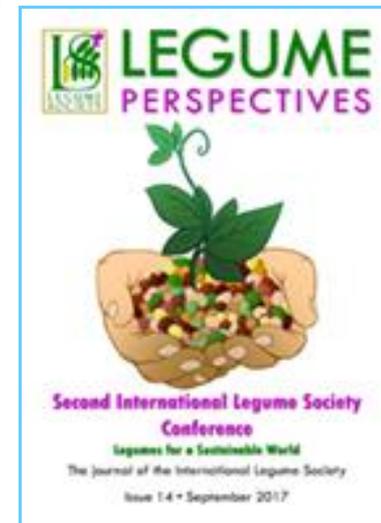
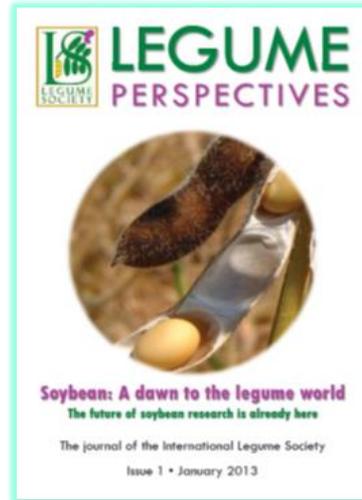


Communication

Legume Perspectives

<http://ils.nssme.com/#journals>

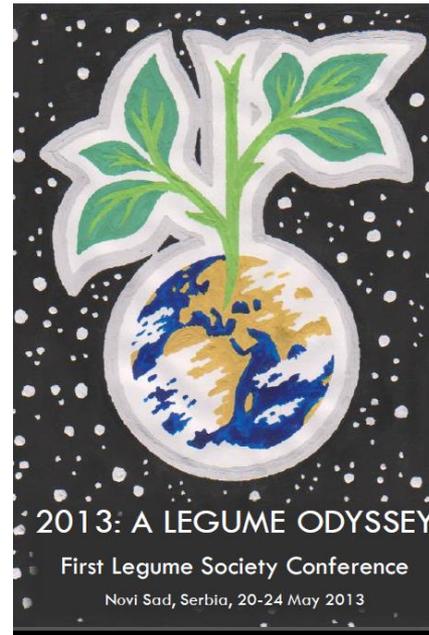
ISSN 2340-1559



Several issues being currently edited



International Legume Society Conferences



Second International Legume Society Conference



Responsibilities in other international projects



CYTED (Iberoamerican)
Phaseolus genome project, 2009-2012



GRDC Australian project
Managing on-farm biosecurity risk through pre-emptive breeding



Global Crop Diversity Trust project.
Using Crop Wild Relatives for Future Lentil Breeding
2014-2017



Genome Canada.
2015-2019

APPLICATION OF GENOMICS
TO INNOVATION IN THE LENTIL ECONOMY

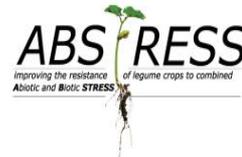
Recent EU research projects covering (partly) legume breeding activities

FP7

medi^{es}



Legume
Futures



H2020



Is this sufficient? Will this impact the legume industry?
What else is needed?

At present Europe exports science but imports grains