Session 13 : Revisiting a long lasting and unsolved problem with a systemic approach: the case of pulses development in agri-food systems

PULSES DEVELOPMENT IN AGRI-FOOD SYSTEMS: SOCIOTECHNICAL LOCK-IN AND UNLOCKING

Marie-Hélène Jeuffroy,

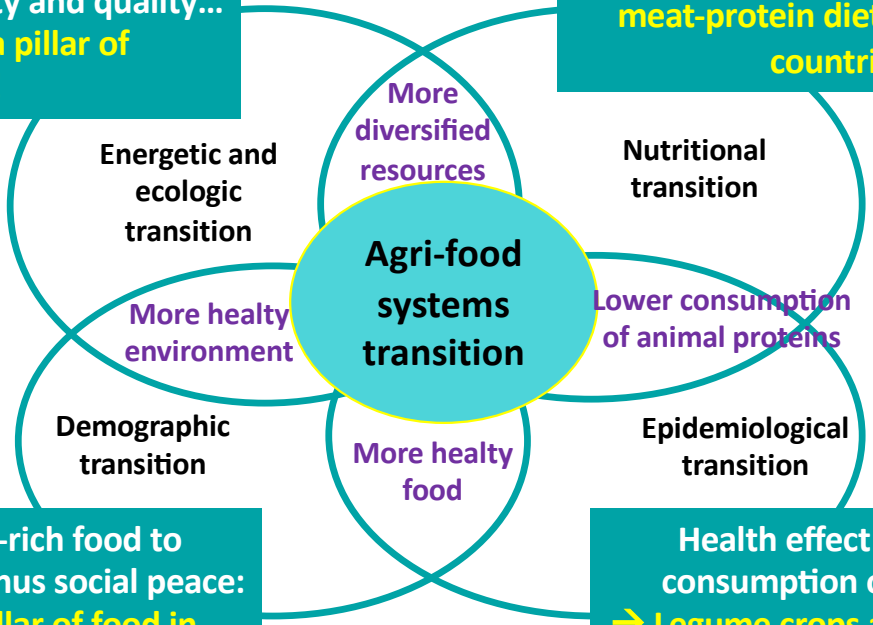
INRAE – IDEAS (Initiative for Design in Agrifood systems), **FRANCE**

with the contributions of Alice Lamé, Marie-Benoit Magrini, Elise Pelzer, Anne Périnelle, Jean-Marc Meynard

Legumes are a pillar of the agrifood system transitions toward sustainability

Numerous and various ecosystem services provided by legume crops:
↘ GHG emissions, ↘ energy use, ↗ biodiversity, ↗ soil fertility and quality…
→ Legume crops are a pillar of agroecology !

Nutritional properties, complementarity with cereal ones:
→ Legume crops are a pillar of low meat-protein diets in western countries



Cheap and local protein-rich food to increase food security and thus social peace:
→ Legume crops are a pillar of food in developing countries

Health effect of regular consumption of legumes:
→ Legume crops are a pillar of a healthy food for all ages (specifically elderly people)

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But their development in Europe is hampered by a sociotechnical lock-in

Magrini et al., 2016; Meynard et al., 2018

Field:
Lower yield compared to major crops + variability of ecosystemic services provded unexplained, and unpredictable

Farm :
Scarce consideration of the economic return of legumes on the following crops

Breeding :
Low number of available cultivars and low increase of annual yield (genetic progress)

Advisory services:
Lack of technico-economic references on crop management and on preceding effects

Collecting firms :
More complex and more expensive logistics on species with low volumes

Policies:
Successive actions unfavorable or not permanent concerning legume crops

Upstream

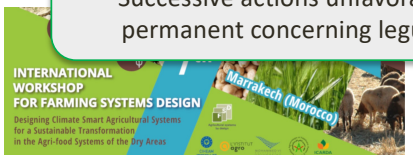
Unsufficient coordination between actors to consolidate a fragile value chain: information flow and incentives

Downs-tream

Industry/ transformation :
High transaction costs for minor species / Difficulty for some processes / Low use in food / standards developed for major crops

Consumption :
Bad flavour from grain legumes ; low habit to eat legumes,

Environnement:
The environmental interest of these species not explained or not recognized by consumers



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But their development in Europe is hampered by a sociotechnical lock-in

Magrini et al., 2016; Meynard et al., 2018

Numerous interconnected obstacles, linked to a progressive alignment of the practices of actors from upstream and downstream of value chains, reinforcing major species

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All actors are interconnectd in their activities and have interest to manage a small number of major species, thus marginalising legume crops.
This lock-in is systemic and collective (no scapegoat; all actors are jointly responsible)

➔ **How to unlock the system ?? Various approaches**

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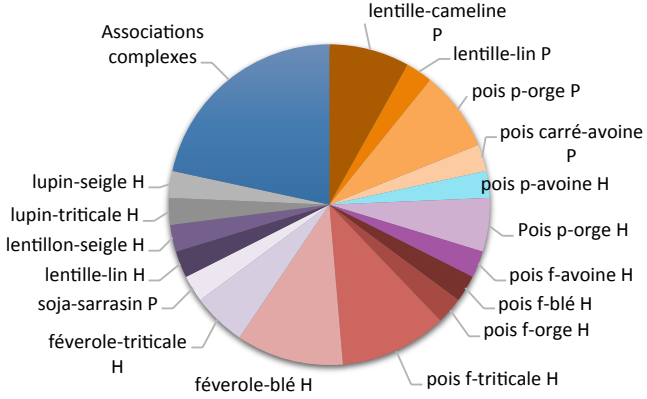
Unlocking: Next to the dominant system, some farmers grow legumes : they have invented practices (rare but satisfactory) ➔ understanding how they do may help disseminating new type of knowledge for further innovations

Lamé et al., 2015

15 farmers interviewed



➔ 38 grown intercrops

Type	Outlet of the harvested product	**Performance criteria favoured by farmers**	Most frequent species	Periods of sowing	Nb. Of weeding operations	Sorting species before use	Work load
1	Sale outside the farm	**No technical operation between sowing and harvest**	(2) Lentil, camelina, buckwheat	May	0	Yes	Low
2	Feed for the animals on farm	**No technical operation between sowing and harves**	(2 à 7) forrage pea, vetch, rye, triticale, wheat	September - october	0 to 1	No	Low
3	Feed for the animals on farm	**Decrease weeds in winter-crop rotation ➔ spring sowing**	(2) pea, wheat, barley	February to April	1 to 2	No	Medium
4	Sale outside the farm	**Produce high-protein wheat for sale**	(2) Winter Wheat + pea, fababean, lupin	October to Décember	2 to 3	Yes	High

Practices (species, density, N fertilization, weeding, sorting) are highly consistent with the satisfaction criteria of the farmers
➔ 4 agronomic logics

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Unlocking: Articulating on-farm innovation tracking, prototyping trials and adaptation trials helped to develop legume-based systems in Burkina Faso

Périnelle et al., 2021, 2022

On-farm innovation tracking

Candidate cropping systems

Prototyping trials on village experimental station

Individual and collective assessment of the experimented candidate CS with farmers

Adaptation trials by farmers in their own fields

Innovative legume-based cropping systems adapted and adopted by farmers (29/39)

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Unlocking: Coupled innovations are required to unlock the system : ex. of a legume value chain developed thanks to interconnected innovations

Meynard et al., 2017

Agronomical innovation: lentil-wheat intercrop to increase protein content in wheat grains with low environmetal impacts

Service innovation: specific advice to farmers and multi-annual cost accounting

Technological innovation in logistics:

New silo for storage, optical sorter

Organisationnal innovation: Production contract with guaranteed minimum price; fair trade charter …

Marketing innovation : creation of a brand ; development of local distribution

Varietal innovation: partnership strategy with a breeder of diversification species

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Unlocking: Collective design of legume-based cropping systems and uses may help to design scenarios for new agrifood systems within territories

Pelzer et al., 2020

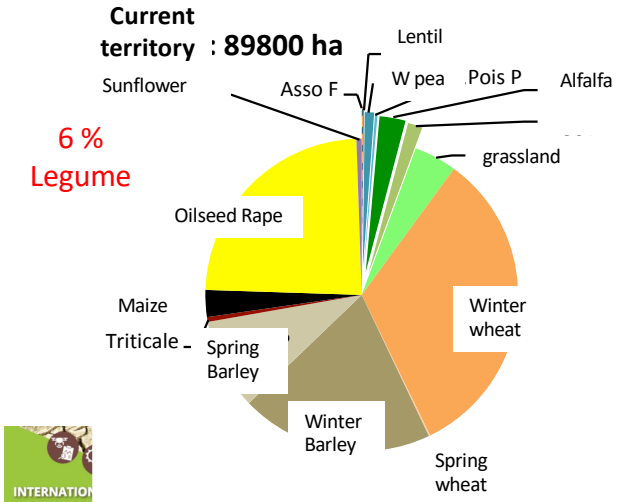
Step 1
Workshops to co-design legume-based cropping systems for the territory

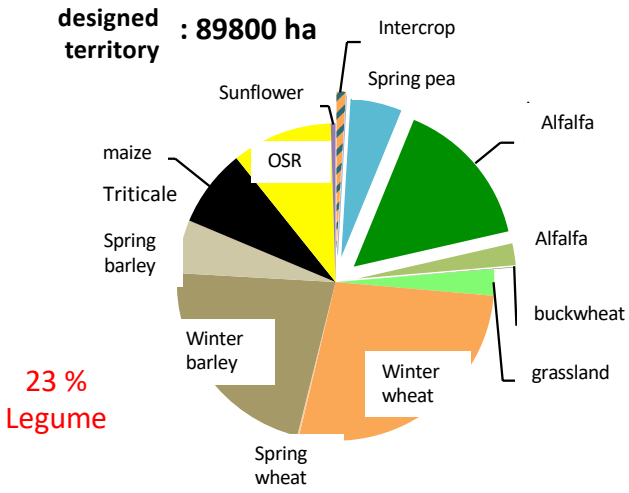
Step 2
Description and multi-criteria assessment of current and innovative farming systems

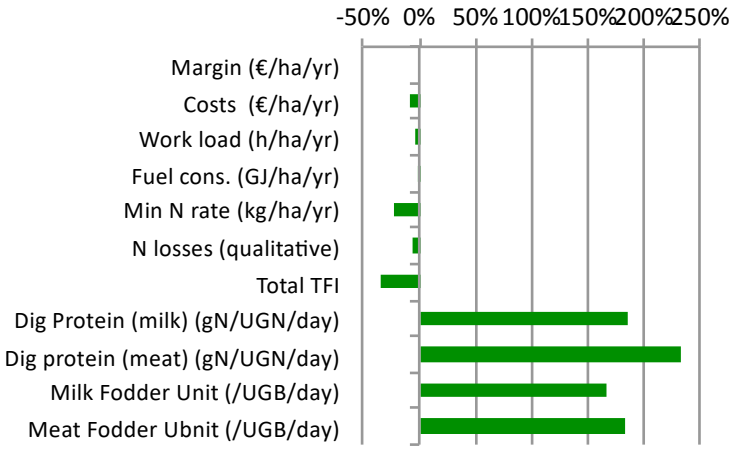
Step 3
Definition, with the territory actors, of the contraints and new targets for the territory

CO-CLICK'EAU
Constraint-based optimization

Step 4
Design and multi-criteria assessment of prospective scenario (includnig the development of legume crops) for the territory







Change (%) in performances compared to current territory

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Conclusion

Supporting the development of legume-based agrifood systems to foster transitions should be enhanced by:

- **Stronger collaborations between research in agronomy, food science, design, social sciences, … ➔ enhance transdisciplinarity in research projects**
- **Stronger innovation-oriented research ➔ strengthen back-and-forth links between knowledge production and innovation**
- **Stronger interactions between research and actors / stakeholders ➔ foster action-research in multi-actor projects (linking agriculture and food processing)**
- **Developing capacity-building of actors for open innovation ➔ combine research, teaching and innovation-support around dedicated methods**

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Thank you for your attention!

marie-helene.jeuffroy@inrae.fr

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