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MoBiDiv - Mobilizing and Breeding Intra and inter-specific crop DIVERSity for a systemic change towards pesticide-free agriculture

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GROWING PROTECTING differently



• **MO**obilizing and **B**reeding Intra and inter-specific crop **DIV**ersity for a systemic change towards pesticide-free agriculture

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CONTEXT

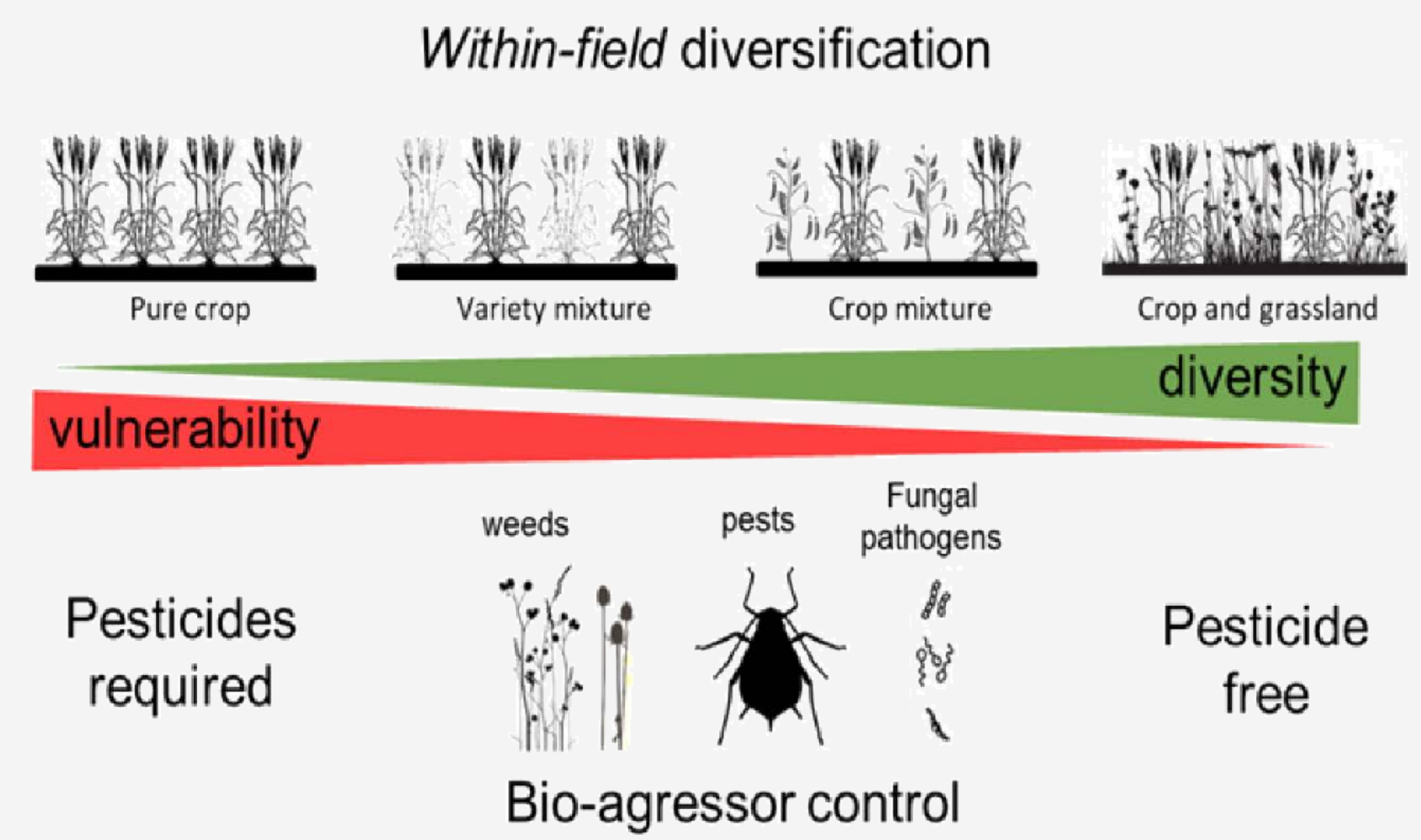
Current situation: A system focused on the paradigm of (varietal) homogeneity:

- Breeding schemes for homogeneous varieties (lines/hybrids)
- Royalty-based research concentrates research on dominant crops
- Knowledge and advice focused on pure crops
- Varietal evaluation in pure crops
- Pure crop based market standards
- Seed sector mostly selling pure varieties to farmers

Increasing within-field diversity reduces pesticide use:

- Known effect on pest, disease and weed control (eg., Borg et al. 2018)
- A recognized effect of diversification on crop stability (Li, ..., van der Werf 2020; Paut et al. 2020)

Mobilizing intra-plot diversity with gradients boosts natural regulation and reduces dependence on pesticides:



OBJECTIVES AND ORGANISATION

Outlines & outputs:



WP1 - National data

Analysis of intra-field diversification dynamics in France, impact on biotic pressures, biodiversity and pesticide use

Methodology: Statistics, Data analysis



WP2 - In lab

Identification of plant-plant interaction mechanisms and impact on pest, weeds and diseases control

Methodology: Modelling, Genetics and molecular approaches



WP3 - In field

Evaluation of the impact of diversification on pest control

Methodology: Field trials



WP4 - In firms and farms

Design of methods that can be used to select and design varieties and species mixtures

Methodology: Modelling, data analysis in farmers networks and experimental stations



WP5 - In the seed sector

Design of tools and policies to encourage the involvement of economic actors in a diversification strategy

Methodology: Participatory approaches, qualitative surveys, micro-economic modelling

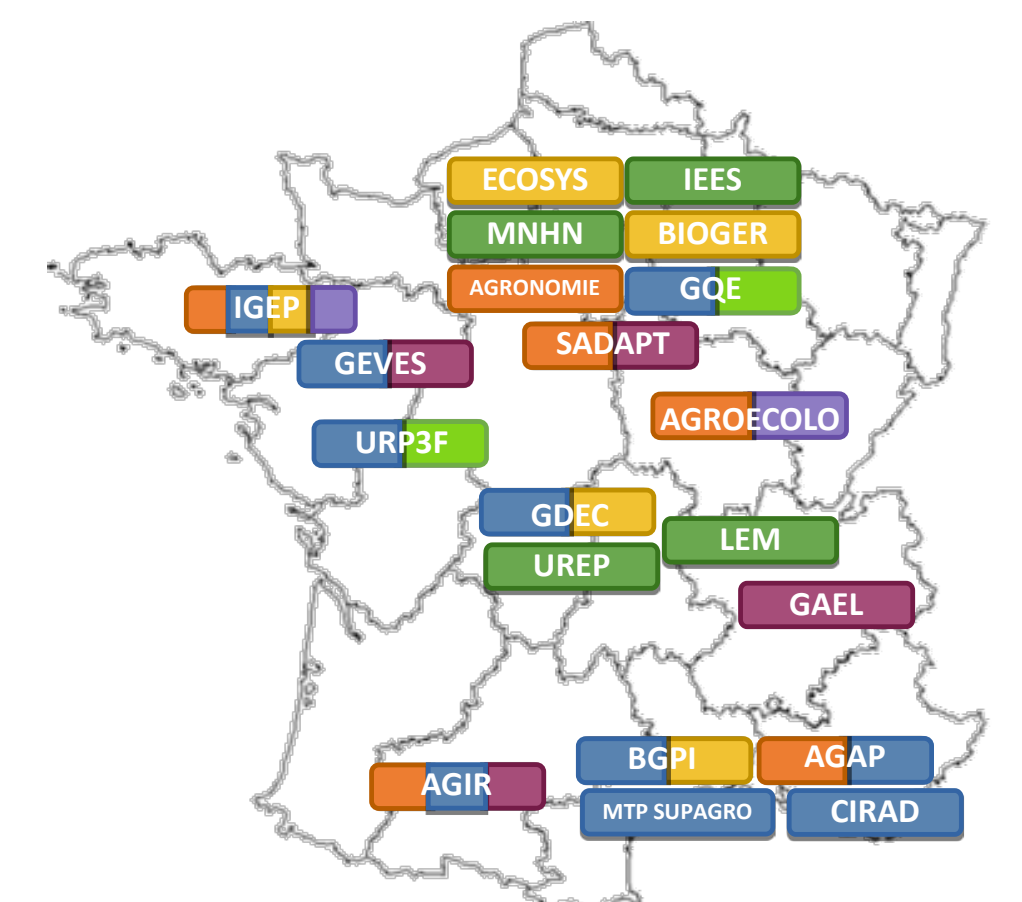
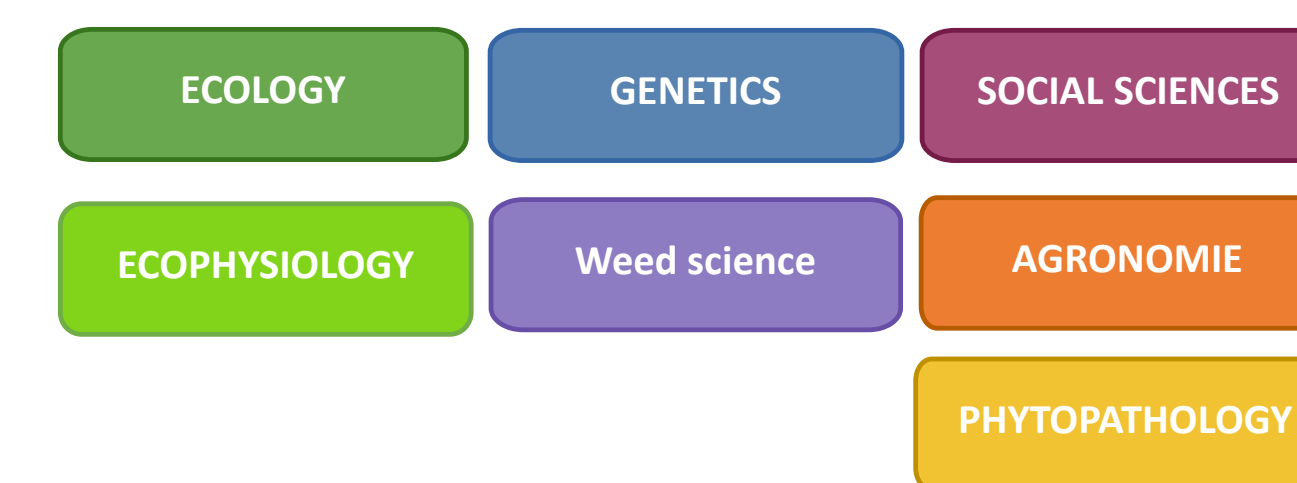
With 3 model crops:

- Wheat, main player of pesticides in France
- Peas, a good legume partner
- Fodder crops & grassland, emblematic for biodiversity and ecosystem services

Multi-actors at multiple scales of the agroecosystem:



Multi- and transdisciplinary approaches:



EXPECTED RESULTS

- Demonstration of the benefits of mixtures in pests regulation and in pesticides reduction
- Co-designed decision support tools for mixtures design
- Identification of traits and genomic regions driving mixing ability
- Plant ideotypes adapted to mixtures
- Co-designed tools for breeders and farmers (breeding schemes, models, markers, phenotyping strategies)
- Methods and know-how for participatory breeding and evaluation of mixtures
- Regulatory and financing tools for diversification
- Scenarios for relaxing upstream and downstream quality standards

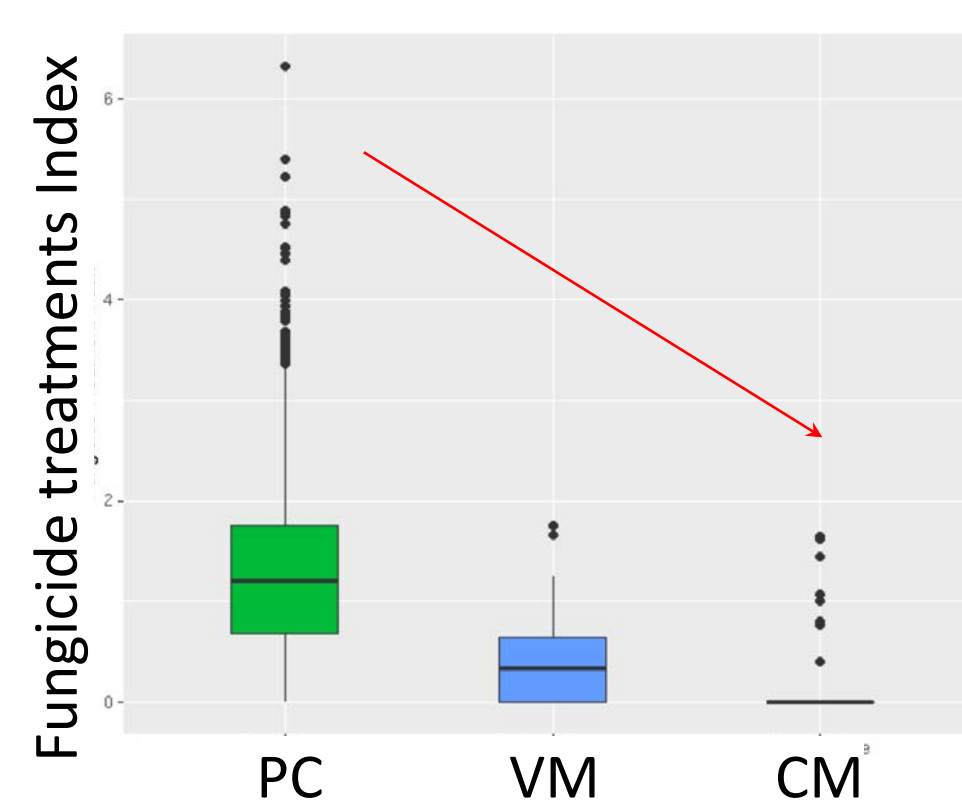


Fig1. An effective decrease in pesticide use with PC : (Wheat) Pure crop; VM : Variety mixture; CM : Crop mixture

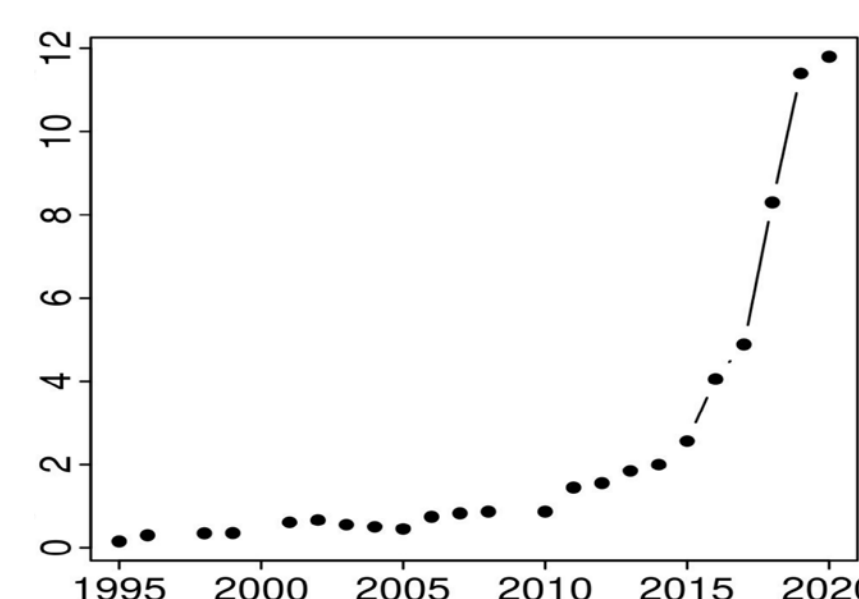
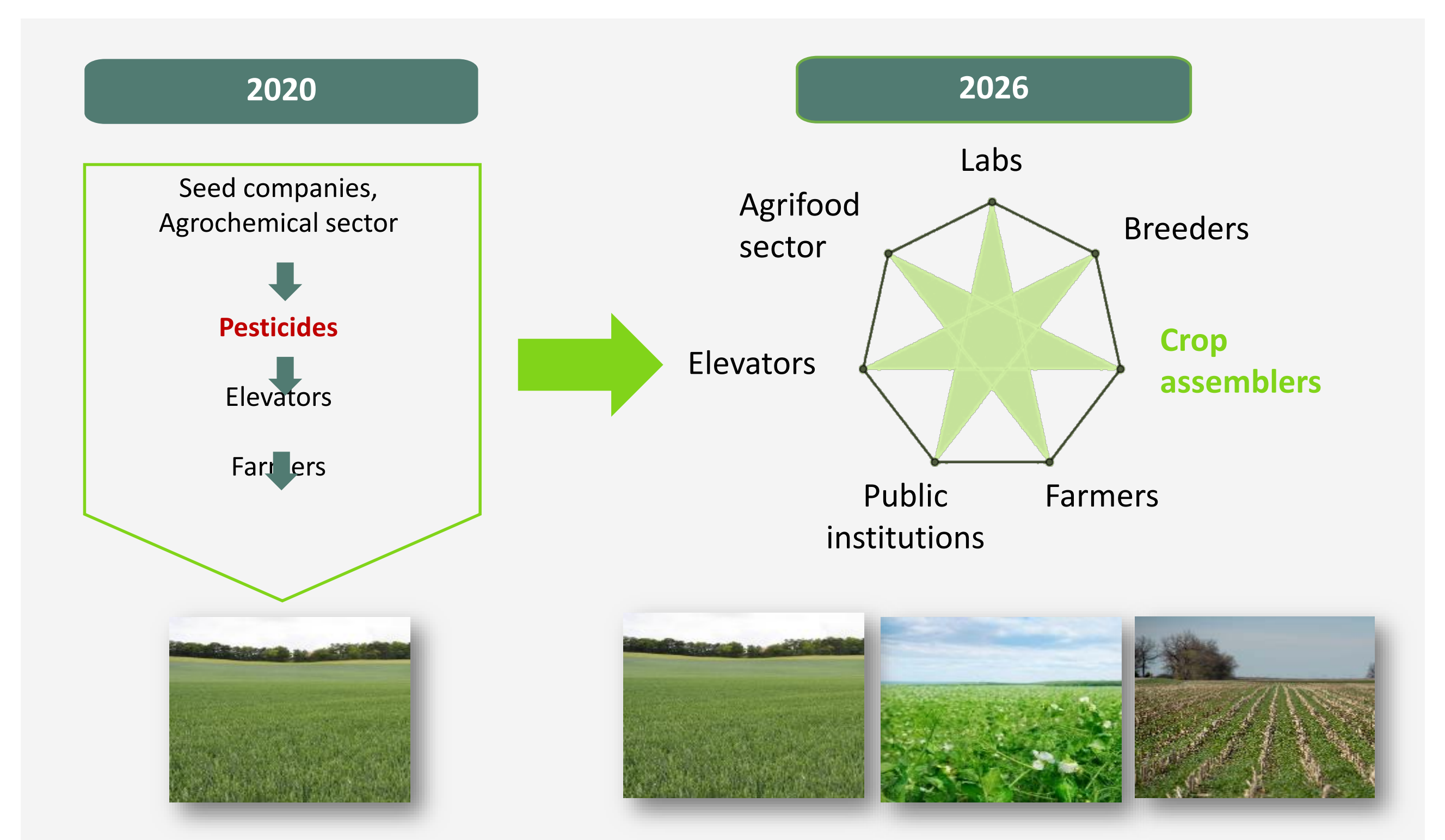


Fig 2. Progression of mixture use in farms

& PERSPECTIVES

Transformation and diversification of the seed sector:



CONCLUSION

MOBIDIV aims at creating methods and tools to select, assemble, register and evaluate varieties for zero-pesticide agriculture.

- ✓ Breeding programmes for the production of mixtures
- ✓ Changing regulations on variety registration
- ✓ Ready-to-use mixtures available to farmers
- ✓ Organisations providing specific advice on mixtures
- ✓ Increasing adoption of mixtures
- ✓ Cooperatives accepting deliveries of mixtures



www.inrae.fr/mobidiv