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## For the Love of Wise Agronomy: Transition Paths to Legume Supported Food- and Feed-Systems in Europe

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**Abstract:** The importance of biological nitrogen fixation, as delivered by legume supported cropping systems to help underpin sustainable food production, is generally agreed by stakeholders spanning the whole supply-chain. Despite this, legume-supported cropping-systems in Europe remain underutilised, as the vast majority Europe's protein requirement is satisfied by sources external to the continent. Such imports originate predominantly from the Americas and are mainly delivered in bulk as soybeans which constitute a major component of animal feeds. This scenario caters for consumer demands within Europe, and meets the rising international demand for meat consumption. The result is European cropping systems dominated by non-legumes requiring large inputs of man-made mineral-nitrogen fertiliser plus other nutrients and pesticides with consequent negative environmental impacts, including poor human diets.

Even if aggregation of European legume production were to offset such imports, a large-scale 'home-grown' approach would likely fail to underpin sustainable food systems, as environmentally unsustainable levels of meat consumption would be maintained, nor new consumption patterns, or 'sustainable diets', encouraged. Improving gross-margins for farmers through more profitable short supply chains that may sustain local economic development and enhance valuable regional food cultures presents a viable alternative vision. Since it is also important that legume-based commodities become accessible to smaller-scale processors, to be attractive and affordable - as demanded by the growing number of 'consumer-citizens'. The transition-paths to legume supported feed- and food-systems are therefore complex, and demand a series of transitions from education to capacities and cultures throughout the supply-chain. Furthermore, the balance of small- and large-scale operations will need tailored to the ambitions identified by European, national and regional strategic development programmes.

Such observations offer a glimpse of initial findings from the first series of multi-stakeholder European Legume Innovation (ELIN) workshops held by the EU-funded TRUE project ([www.true-project.eu](http://www.true-project.eu)). The perspectives highlight that good agronomy alone cannot realise legume supported food- and feed-chains, and that cooperative effort throughout the food-system will be essential. This feedback is discussed with respect to other aspects of the TRUE research project that assesses the capacity of legumes as the foundation to realising 'environmental-

diets', and a means by which we may harmonise the ambitions of consumers and commerce, whilst also meeting environmental needs and safe-guards.

**Keywords:** Biological nitrogen fixation, legumes, sustainable food systems, environmental diet, consumer citizen

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## Co-Design and Assessment of Agronomic Scenarios of Reintroduction of Legumes Into a French Territory

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**Abstract:** Legume crops should be enhanced in European areas as they can help facing current environmental and food challenges. However, their areas have seriously decreased since several decades. The aims of our study were (i) to design with local stakeholders agronomic scenarios of reintroduction of legumes into a French territory, (ii) to assess these scenarios *ex ante* thanks to the characterization of their performances, and (iii) to discuss with the stakeholders the interest and conditions of their adoption in the territory. This study was carried-out on the *Plateau Langrois* territory (89 800 ha), in Burgundy, France. The stakeholders involved were farmers, technical advisors from local collect firms or technical institutes, researchers... The first step was the description of the current territory with local stakeholders (face to face surveys and a workshop). Three zones were distinguished: (i) arable crops farming (46% of the area), (ii) mixed crop-dairy (23%) and (iii) beef farming (31%). Land-use (*i.e.*, acreage of each crop) was characterized for each zone. Current crop management plans were described for each zone, as well as a set of alternative crop management plans specifically designed by stakeholders. Crop management plan is to be understood as the combination of a crop and management, among three management modes: organic, low input and high input conventional farming. In a second step (during the first workshop), stakeholders discussed various sets of objectives and constraints related to their territory and concerning for example the collect (*e.g.*, volume of organic wheat to be reached at territorial scale) or the environment (*e.g.*, water quality in the catchment area). In a third step, these sets of objectives/constraints were translated in agronomic scenarios. Four scenarios (among eight proposed by stakeholders) were simulated with the optimization tool used in the Cocl'ick'eau approach. The scenarios were (i) develop organic production, including organic wheat to provide a local mill, (ii) increase forage and protein-rich crop production, (iii) reduce the impact of crop management on water quality, iv) combined all those objectives in a fourth scenario. Based on the set of objectives and constraints and crop management plans described, the optimization tool proposed for each scenario an alternative land-use (proportion of area covered by crop\*management modes by zone) and estimates its performances through agronomic (*e.g.*, yields (Mg ha<sup>-1</sup>), proteins produced for cattle), socio-economic (*e.g.*, margin (€ ha<sup>-1</sup>), labor time (h ha<sup>-1</sup>)), and environmental indicators (*e.g.*, pesticide use (TFI), mineral fertilizer use (kgN ha<sup>-1</sup>)). The results of each scenario (land-use and indicators of performances) were compared to the current territory. Area with legume crops increased from 3.6 to 17.6% depending on the scenario. In a last step, during a final workshop, the simulated scenarios and their performances were discussed with stakeholders, as well as the conditions of possible adoption in the territory.

**Keywords:** Legumes, territory, design, optimization tool



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# ABSTRACT BOOK

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# INNOVATIVE CROPPING AND FARMING SYSTEMS FOR HIGH QUALITY FOOD PRODUCTION SYSTEMS

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