WP 1. DRIVERS OF FARMERS' PRODUCTION PRACTICE AND CROP PROTECTION CHOICES

Leader: A. Carpentier (SMART-LERECO)
The research projects of WP1 aim to analyse and quantify the effects of the main drivers of farmers' crop protection choices, with the view to explain the current dependence of crop production on chemical pesticides.

Task 1.1. Critical survey of the economic literature on pesticide use Participants: A. Carpentier, F. Féménia, A. Gohin (SMART-LERECO), R. Ballot (Agronomie), B. Grimonprez (CECOJI)

Task 1.1.1 Review of the drivers of farmers' pesticide use and pesticide saving crop production practices. This work will build on previous surveys (Sexton, Lei, and Zilberman 2007; Skevas, Lansink, and Stefanou 2013) and expertise reports (Carpentier et al. 2005). This analysis of farmers' crop protection drivers, which is focused on economic drivers, will be completed by research results found in agronomy and sociology articles and reports (Aubertot et al. 2005; Kremen, Iles, and Bacon 2012; Lamine et al. 2011; Lin 2011; Matson et al. 1997; Meynard et al. 2013, 2018; Tilman et al. 2002).

Task 1.1.2 Survey and analysis of the regulation related to pesticide use. This law research work will be carried out at the French and European levels, with a specific focus on its impacts on crop protection strategy choices (Doussan and Thevenot 2013; Thevenot 2014). The effects of private and public standards, including their combination, on pesticide use reductions will also be considered (De Lombardon and Grimonprez 2018).

Task 1.1.3. Designing an analytical framework for analysing both agronomic and economic drivers of farmers' crop production practices, along the lines of Gohin et al. (2015). This framework is to be used for mapping the models to be considered in Task 1.2 and Task 1.3 as well as for conceiving crop production models in Task 1.4.

Deliverables:

D111 [Scientific report, M10] Literature review on the drivers of farmers' pesticide use (A. Carpentier);
D112 [Scientific report and policy brief, M18] Literature review on the drivers of farmers' pesticide use and adoption of pesticide saving practices: legal issues (B. Grimonprez);
D113 [Scientific report, M24] Micro-econom(etri)c model of farmer production choices, including pesticide saving production practices (A. Carpentier).

Task 1.2. Analysing and quantifying the effects of pesticide use drivers Participants: A. Carpentier, P. Dupraz, F. Féménia, C. Heinzel, E. Letort (SMART-LERECO), R. Chakir, F. Bareille, IE (M10-M21) (Economie Publique), T. Poméon, M.-T. Corre, P. Cantelaube, C. Gendre, Post-doc (M12-M29) (ODR), P. Crosetto (GAEL), D. Bougherara (CEEM), C. Nauges (TSE).

Task 1.2.1 Crop diversification, climate conditions and landscape drivers. This task brings together three research projects that rely on micro-econometric modelling techniques. The first one will investigate how crop acreage diversification impacts pesticide use, along the lines of Bareille and Letort (2018). The second project will make use of pesticide use data available at the municipality level combined with datasets describing a comprehensive set of crop protection choice drivers (including data on cropping and production systems, local institutions, farm organizations, access to specific outlets, and controlling for soil and climate conditions). It will focus on the impacts of the economic and regulatory environment while accounting for spatial spillover effects. The third project will consider the effects of standard economic drivers (Bayramoglu and Chakir 2016) as well as climatic and landscape drivers (Allaire et al. 2015; Chakir and Le Gallo 2013). These results will be used to run simulations on the impacts of public policies and climate change on pesticide use.

Task 1.2.2 Risk aversion and pesticide use. This task brings together three projects that consider risk issues related to chemical crop protection. The first one will propose new experiments for eliciting farmers' risk preferences (Crosetto and Filippin 2016; Pedroni et al. 2017). The second one will extend the study of Carpentier and Reboud (2018) to analyse farmers' spray decisions, relying on insights from economic psychology. The third one will investigate the relative impact of farmers' attitude toward risk on pesticide uses, based on both theoretical and experimental analyses, as initiated in Groom et al. (2008), Bougherara et al. (2017b) and Bougherara and Nauges 2018).

Deliverables:

D121a [Scientific report, M36] Analysis of the effects of crop diversification on pesticide use (P. Dupraz);

D121b [Scientific report, policy brief and data paper, M30] Econometric analysis of pesticide use at the municipality level (T. Poméon);

D121c. [Progress report, M25] Econometric analysis of the drivers of pesticide use with a focus on landscape structure and climatic drivers (R. Chakir);

D121d. [Scientific report, M39] Econometric analysis of the drivers of pesticide use with a focus on landscape structure and climatic drivers, and related simulations (R. Chakir);

D122a. [Scientific report, M16] Meta-analysis on risk attitude measures (P. Crosetto);

D122b. [Scientific report, M18] Innovative measurement of attitudes toward risk, lab experiment (P. Crosetto);

D122c. [Scientific report, M29] Innovative measurement of attitudes toward risk, field experiment (P. Crosetto);

D122d. [Scientific report and policy brief, M36] Analysis of farmers' pesticide spray decisions based on the Prospect Theory (A. Carpentier);

D122e. [Scientific report, M10] Analysis of the relative weight of risk aversion in farmers' pesticide uses (D. Bougherara);

D122f. [Scientific report, M27] Analysis of pesticide use and insurance contracting at the intensive margin using lab experiments (D. Bougherara);

D122g. [Scientific report, M39] Analysis of pesticide use and insurance contracting at the extensive margin using lab experiments (D. Bougherara).

Task 1.3. Investigating and modelling adoption of pesticide saving production practices
Participants: F. Féménia, E. Letort, Aude Ridier, C. Ropars-Collet, Post-doc (M1-M18) (SMART-LERECO), A. Fadhuile (GAEL), M. Carof (SAS), A.-L. Jacquot (PEGASE)

Task 1.3.1 Drivers of pesticide-saving practices. This task will identify farmers using pesticide-saving practices in arable crop production systems and analyse the economic drivers of this practice choice, based on combined datasets on detailed cropping management practices and farm accountancy data, along the lines of Femenia and Letort (2016) and Fadhuile, Lemarié, and Pirotte (2016).

Task 1.3.2 Drivers of the adoption of organic production practices. This work will apply micro-econometric modelling techniques to farm accountancy data covering a large sample of mixed crop-livestock farms in Brittany over the last two decades.

Task 13.3. Impediments of the adoption of pesticide free weed control techniques. We will use interview and choice experiment techniques (Blazy, Carpentier, and Thomas 2011) to investigate the drivers and impediments of the adoption of pesticide free weed control techniques by mixed crop-livestock farms in Brittany, with a special focus on labour issues due their prevalence in these farming systems Jacquot et al. (2014) and for adopting agro-ecological practices in general (Delecourt, Joannon, and Meynard 2019; Dumont and Baret 2017; Ridier et al. 2013).

Deliverables:

D131 [Scientific report and policy brief, M39] Micro-econometric analysis of farmers' pesticide use in arable crop based on a combination of economic and agronomic data (F. Féménia);
D132 [Scientific report and policy brief, M24] Micro-econometric analysis of farmers' adoption of organic roduction practices in Brittany (E. Letort);
D133 [Scientific report, M18] Analysis of Breton farmers' adoption of pesticide free production practices in mixed crop-livestock farms based on a choice experiment (A. Ridier).

Task 1.4. Integrating pesticide use and pesticide saving production practices in crop production models Participants: A. Carpentier, F. Féménia, A. Gohin, E. Letort, Post-doc (M6-M29) (SMART-LERECO), R. Ballot, Post-doc (M7-M30) (Agronomie), P.-A. Jayet, IE (M1-M18) (Economie Publique), T. Poméon (ODR).

In this task, we will make use of the analytical framework and insights from Task 1 to develop large scale simulation models (France and EU) aimed to assess the effects of various pesticide use reduction level scenarios (up to zero pesticide use) on the supply of agricultural commodities. They will be used as inputs or modules in the partial/general equilibrium models to be developed in WP3.

Task 1.4.1 Reference indicators of performances and input requirements. In this task, we will estimate sets of technical and economic indicators (i.e., yield levels, chemical input uses, mechanization costs) describing the input requirements and performances of pesticide saving production practices.[1] These reference indicator sets will then be used in two models specifically developed for this project, to describe the main French crop production areas: the AROPAj model and a Multinomial Logit (ML) production choice model.

Task 1.4.2 Adapting AROPAj model. The agricultural supply model AROPAj, which was primarily designed and used for investigating issues related to nitrogen pollution and climate change (Aghajanzadeh-Darzi, Jayet, and Petsakos 2017; Durandeau et al. 2010; Humblot, Jayet, and Petsakos 2017; Jayet and Petel 2015), will be adapted for integrating pesticide use and pesticide saving practices, based on the references established in T1.4.1. This linear programming model is calibrated for covering the main European agricultural production areas.

Task 1.4.3 Constructing a micro-econometric production choice models. The micro-econometric modelling framework developed by members of SMART-LERECO (Carpentier and Letort 2014; Koutchadé, Carpentier, and Femenia 2018; Koutchadé, Carpentier, and Femenia 2019) will be used for constructing a micro-economic agricultural supply model. The specific structure of the ML production choice model makes it especially suitable for simultaneously modelling acreage, yield levels and chemical input uses on the one hand, and discrete production practice choices (including crop level cropping management practices and cropping systems in the case of arable crops) on the other hand.

Task 1.4.4 Simulation exercises. The two models developed in Task 1.4.2 and Task 1.4.3 will then be used for running simulation exercises of crop protection scenarios or implementation of policy instruments fostering pesticide use reductions.

Deliverables:

D141a. [Progress report and data, M24] Technical and economic references on pesticide saving production practices, literature review (R. Ballot);
D141b. [Scientific report and data, M30] Technical and economic references on pesticide saving production practices from production practice survey data (R. Ballot);

[1] A more detailed description of the technical steps carried out in Task 141 can be found here: http://web.supagro.inra.fr/partage/subervie/PPR/PPR_FAST_task141.pdf

D141c. [Scientific report and data, M36] Technical and economic references on pesticide saving production systems of arable crops from the Persyst expert knowledge elicitation method (R. Ballot);
D142a. [Progress report, M18] Integrating pesticide saving production practices in the micro-economic agricultural supply model AROPAj, method and preliminary results (P.-A. Jayet);
D142b. [Scientific report, model, M33] Integrating pesticide production practices in the micro-economic agricultural supply model AROPAj, final model and simulation results (P.-A. Jayet);
D143a. [Progress report, M16] Estimation methods of micro-econom(etri)c models of farmer production choices including pesticide saving production practices based on FADN data (A. Carpentier);
D143b. [Progress report, M28] Micro-econom(etri)c models of farmer production choices including pesticide saving production practices based on FADN data: first estimation results (A. Carpentier);
D143c. [Scientific report, model and policy brief, M42] Calibration of a micro-economic agricultural supply model for France based on estimated micro-econom(etri)c models of farmer production choices (A. Carpentier);
D144 [Scientific report and policy brief, M60] Simulation of the effects of pesticide use reduction policies based on two micro-economic agricultural supply models for France (A. Carpentier).