Economic and ecological drivers of temporal fluctuations in pesticide use

Supervisors/ Encadrement

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Duration/ Période - Durée

6 month between February and September 2022

6 mois entre février et septembre 2022, avec souplesse possible sur la date de début et fin de stage

Presentation of the thesis project/ Présentation du projet de stage

The reduction of environmental and health risks from pesticide use is on top of the agenda of policymakers and food-value chain actors worldwide. However, recent studies show that pesticide risks are still growing and pesticide policies have not proved effective and efficient in reducing risks (Möhring et al., 2020).

The design of effective and efficient tools and policies for risk reduction especially requires a deep understanding of the heterogeneous temporal dynamics of pesticide use, both intra- and inter-annual, as well as their economic and ecological drivers. Temporal peaks in toxicity during the growing season may for example lead to extreme risks, which can be key for ecotoxicity and health effects due to underlying non-linear dosage-effect relations (Möhring, Gaba and Finger, 2019). Understanding trends and variability in pesticide use decisions over the years is key to understand and account for drivers of (long-term) change in pesticide use decisions. Both intra- and inter-annual temporal dynamics of pesticide use may be i) driven by environmental (e.g. weather, landscape, pest pressure) and socio-economic conditions (e.g. prices of inputs and outputs, restrictions on used pesticides), ii) be strongly heterogeneous over crops and growing systems and iii) may be connected and have feedbacks. While intra- and inter-annual trends in pesticide use have been separately analyzed in the past (e.g. Hossard et al., 2017; Larsen et al., 2019), an understanding of their connections and main economic and ecological drivers is missing.

The goal of the master thesis is to analyze intra- and inter-annual trends of pesticide use in two main French field crops: winter wheat and rapeseed. While wheat is the most abundant crop in French and European agriculture, rapeseed is the field crop with one of the highest pesticide loads. A descriptive analysis of the temporal dynamics will be followed by an econometric analysis (panel data/time series) of their main economic and ecological drivers/associations.

The project will take place in the Zone Atelier Plaine & Val de Sèvre (ZAPVS; Bretagnolle et al. 2018), an agricultural landscape located south of Niort (Deux-Sèvres), which provides long-term data on ecological functions and processes, as well as agricultural practices. The first part of the project will consist in identifying and collecting data on economic drivers of pesticide use decisions (i.e. in- and output prices).

The second part will consist in empirical analysis of pesticide use dynamics and their drivers. Throughout the project, the supervisors will provide expertise both from the fields of economics and agro-ecology.

References/ Références bibliographiques

Bretagnolle, Berthet, Gross, Gauffre, Plumejeaud, Houte, ... & Gaba (2018). Towards sustainable and multifunctional agriculture in farmland landscapes: lessons from the integrative approach of a French LTSER platform. Science of the Total Environment, 627, 822-834.

Hossard, L., Guichard, L., Pelosi, C., & Makowski, D. (2017). Lack of evidence for a decrease in synthetic pesticide use on the main arable crops in France. *Science of the Total Environment*, *575*, 152-161.

Larsen, A. E., Patton, M., & Martin, E. A. (2019). High highs and low lows: Elucidating striking seasonal variability in pesticide use and its environmental implications. *Science of The Total Environment*, *651*, 828-837.

Möhring, N., Gaba, S., & Finger, R. (2019). Quantity based indicators fail to identify extreme pesticide risks. *Science of the total environment*, *646*, 503-523.

Möhring, N., Ingold, K., Kudsk, P., Martin-Laurent, F., Niggli, U., Siegrist, M., ... & Finger, R. (2020). Pathways for advancing pesticide policies. *Nature food*, *1*(9), 535-540.

Required skills / Compétences particulières exigées

Student in Master 2 or 3rd year of engineering school. Open profile (Economics & agroecology, ecology, environmental/ecological economics)

- - Good level of English (Good level of French is a plus but not required)
- - Autonomy, rigor and initiative
- - Intermediate level in econometrics (Panel/Time series)
- - Competence in the use of R

Etudiant.e en Master 2 ou 3ème année d'école d'Ingénieur. Profil ouvert (Économie & agroécologie, écologie, Économie environmentale/ecologique)

- Bon niveau d'anglais (Un bon niveau de français est un plus mais n'est pas requis)
- Autonomie, rigueur et esprit d'initiative
- Au moins niveau intermédiaire en économétrie (Panel/Time series)
- Compétences en utilisation du logiciel R

Gratification & Hosting conditions/ Gratification & Conditions d'accueil

The student will be hosted at the Centre d'Etudes Biologiques de Chizé (south of Niort) within the Agripop team. He/she will participate in the team's activities.

Gratification at the current rate (~570 euros per month).

Possibility of lodging on site; many roommates around the center.

Collective catering at lunchtime.

Le.la stagiaire sera accueilli.e au Centre d'Etudes Biologiques de Chizé (sud de Niort) au sein de l'équipe Agripop. Il.elle participera aux animations de l'équipe.

Gratification au tarif en vigueur (~570 euros par mois).

Possibilité d'hébergement sur place ; nombreuses colocations autour du centre.

Restauration collective à midi.

How to apply/ Modalités de candidature

Please send a CV and motivation letter to sabrina.gaba@inrae.fr and niklas.moehring@cebc.cnrs.fr before November 29th, 2021.

Faire parvenir un CV et une lettre de motivation à sabrina.gaba@inrae.fr et niklas.moehring@cebc.cnrs.fr avant le 29 novembre 2021.