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Effective and efficient pest management decisions of farmers

Webinar: Pathways for advancing pesticide policies

Organized by World Food System Center and Agricultural Economics and Policy Group, ETH Zurich, Switzerland.

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Agenda

- Framing the problem
- Farmers' decision making process
- Policy instruments for effective and efficient pest management decisions
- Adoption of pesticide-free production systems

Framing the problem

- Farmer behavior is central for effective and efficient pesticide policies.
  - Crucial pest management decisions are made by the farmer.
  - Recent studies: 20-40% of current pesticide use levels can be attributed to inefficient pest management decisions of farmers (e.g. Lechenet et al., 2017; Jacquet et al., 2011; Nave et al., 2013).
  - Understanding farmers' behavior is crucial for the uptake of policies, new technologies and alternative production systems (Dessart et al., 2019).

Lechenet, M., et al. (2017). Reducing pesticide use while preserving crop productivity and profitability on arable farms. Nat. Plants, 3(3).
Jacquet, F., et al. (2011). An economic analysis of the possibility of reducing pesticides in French field crops. Ecol. Econ., 70(9).
Nave, S., et al. (2013). Why wheat farmers could reduce chemical inputs: evidence from social, economic, and agronomic analysis. Agron.Sustain.Dev. 33(4).
Dessart et al. (2019). Behavioural factors affecting the adoption of sustainable farming practices: a policy-oriented review. *Eur. Rev. Agric. Econ.* **46**, 417–471.

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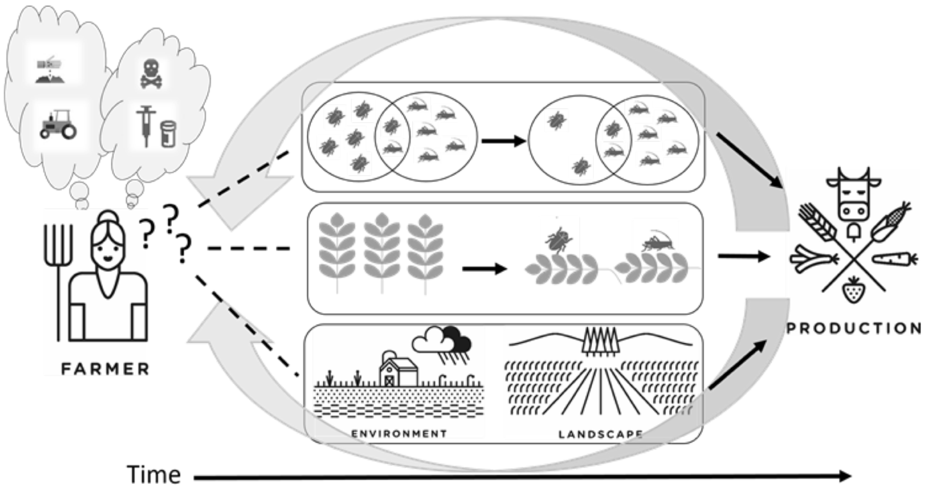
Farmer decision-making processes

- Decisions made by farmers in a complex system under strong uncertainty (e.g. Horowitz & Lichtenberg, 1994).
- Deviation from profit maximizing behavior: uncertainty, information, (risk) perception & preferences, farmers' objectives and habits (e.g. Pedersen et al., 2012, Perry et al., 2019, Möhring et al., 2020a,b).



- Uncertainty may e.g. lead to the use of more toxic pesticides or deviation from effective timing (Möhring et al., 2020a,b)
- Perceptions and risk preferences may, e.g. lead to reduced adoption of technologies/production systems for pesticide reduction.
- Farmer behavior and preferences are heterogeneous (e.g. Pedersen et al., 2012, Iyer et al., 2020).

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Horowitz, J. K., & Lichtenberg, E. (1994). Risk-reducing and Risk-increasing Effects of Pesticides. J. Agric. Econ., 45(1).
Pedersen et al.(2012). Optimising the effect of policy instruments: a study of farmers' decision rationales and how they match the incentives in Danish pesticide policy. Journal of Environmental Planning and Management, 55(8), 1094-1110.
Perry et al.. (2019). Product concentration and usage: Behavioral effects in the glyphosate market. Journal of Economic Behavior & Organization, 158.
Möhring, et al. (2020a). Are pesticides risk decreasing? The relevance of pesticide indicator choice in empirical analysis. *Agric. Econ.* **51**, 429–444.
Möhring et al. (2020b). Why farmers deviate from recommended pesticide timing: the role of uncertainty and information. Pest Manag. Sci., 76(8).
Iyer et al. (2020). Measuring farmer risk preferences in Europe: a systematic review. Journal of Agricultural Economics, 71(1), 3-26.

Policy instruments for effective and efficient pest management decisions

- Heterogeneous behavior and decision rationales of farmers need to be accounted for in policies:
- Differentiated pesticide taxes and subsidies.
  - Account for heterogeneous toxicity of products, heterogeneous preferences and risk premia ((Finger et al., 2017; Möhring et al., 2019).
- Targeted insurance solutions (Norton et al., 2016, Möhring et al., 2020c).
  - Have to consider both, effects on risk and land use decisions to reduce pesticide use.
- Independent and reliable information and extension services.
  - Target uncertainty and lack of information , e.g. information about arrival and severity of pests, new techniques, substitution of pesticides (Rose et al., 2016, Möhring et al., 2020b).

➢ Heterogeneity of farmers implies that allowing for farmers' self-selection can reduce complexity and specificity and may increase cost-efficiency of policies.

Möhring et al. (2019). Quantity based indicators fail to identify extreme pesticide risks. Science of the total environment, 646, 503-523.
Finger et al., (2017). Revisiting pesticide taxation schemes. Ecological Economics, 134, 263-266.
Norton et al., (2016). Applying weather index insurance to agricultural pest and disease risks. International Journal of Pest Management, 62(3), 195-204.
Möhring et al., (2020b). Crop insurance and pesticide use in European agriculture. Agricultural Systems, 184, 102902.
Rose et al., (2016). Decision support tools for agriculture: Towards effective design and delivery. Agricultural systems, 149, 165-174.
Möhring et al. (2020b). Why farmers deviate from recommended pesticide timing: the role of uncertainty and information. Pest Manag. Sci., 76(8).

Adoption of pesticide-free production systems

- Swiss Producer organization IP-SUISSE currently establishing pesticide-free wheat production program.
  - No synthetic pesticides allowed in wheat (but not organic!)
  - Incentives: markup on market price (label) + direct payments
  - Major Swiss retailer Migros: only sells «pesticide-free» bread from 2023 on
  - Goal: large-scale adoption
- PestiFreeWheat Project - ETH (AECP), IP-SUISSE, Migros (JOWA):
  - Goal: Identify determinants, challenges and adoption barriers for the uptake of pesticide-free wheat production in Switzerland
  - Large-scale survey and bio-economic model (Böcker et al., 2019, Möhring &Finger, 2020):
  - ➢ Farmers expectations of the program & risk preferences are central for adoption and have to be accounted for.
  - ➢ Not only expected yields and production risk- expected environmental benefits central.

Böcker, T., Möring, N., Finger, R. (2019). Herbicide free agriculture? A bio-economic modelling application to Swiss wheat production. Agricultural Systems, 173, 378-392.
Möhring, N., Finger, R. (2020). Pesticide-free but not organic? Adoption of a large-scale pesticide-free wheat production standard in Switzerland (In preparation).

Take-home messages

- Pest management decisions are subject to uncertainties, (risk) preferences and expectations.
- Effective and efficient pesticide policies have to account for heterogeneous farmer behavior.
- Adoption of novel, pesticide-free systems is driven by expectations and risks.

➢ Farmer behavior is central for the reduction of environmental and health risks from pesticide use.

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Thank you very much for your attention

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