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## OWC 2020 Paper Submission - Science Forum

### *Topic 1 - Ecological approaches to systems' health*

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### PLANT AND SEED HEALTH IN ORGANIC SYSTEMS: EMBEDDED IN OR DISCONNECTED FROM INTERACTIONS WITH MICROBIAL COMMUNITIES?

Stephanie M. Klaedtke<sup>1, 2</sup>, Catherine Andrienne<sup>3</sup>, Frédéric Rey<sup>4</sup>, Véronique Chable<sup>5</sup>

<sup>1</sup>ITAB, Angers, France, <sup>2</sup>SEED, Liège University, Arlon, <sup>3</sup>Semilles, Faulx-les-Tombes, Belgium, <sup>4</sup>ITAB, Carcassonne,

<sup>5</sup>INRA, Rennes, France

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**Full Paper Publication:** Yes

**Abstract:** A wide range of different, sometimes mutually exclusive, approaches to plant health are practiced within organic farming and seed systems. Plant health management may seek to completely exclude plant pathogens from growing environments and seed systems in a mechanistic, reductionist perspective. On the other hand, it may also aim at resilient cropping systems, involving plant defense mechanisms and complex microbial communities in a more holistic approach. How organic communities define and manage plant health will have implications on the design of organic seed systems and farm agrosystems, as well as on future research agendas. Debates on approaches to plant health have been sparked within community seed networks in France and Belgium. Based on practical experiences and on a review of interdisciplinary literature ranging from crop ecology to microbiology to the social sciences, the options available to organic agriculture in terms of plant and seed health are elucidated.

**Introduction:** All over the globe, networks of seed growers are cultivating crop diversity in fields and gardens. Their contribution to the maintenance of this diversity has been studied, but research has widely left aside their management of plant health.

Among community seed networks managing crop diversity within local environments in Western Europe the question of how to manage plant and seed health is emerging, especially considering seedborne plant diseases. That is, how to collectively ensure health in plants and seeds that are embedded in local microbial and human environments? The European Horizon2020 research project Liveseed broadens these considerations to reflect more generally upon seed health and the role of microbial communities in organic seed systems.

This contribution draws both upon practical experiences and issues with seed health and upon a literature review to elucidate options and choices available to organic agriculture in terms of plant and seed health.

**Material and methods:** The reflexive processes on plant health associating farmers, researchers and other actors has emerged from problematic situations and issues encountered in the field of small-scale organic seed production or community seed networks, within the French association Réseau Semences Paysannes, among others. These issues

concern the following, mainly seedborne diseases: the management of common bunt on bread wheat, bacterial blights on common bean, vascular tomato wilt and canker (*Clavibacter michiganensis*) on tomato and potato virus Y on seed potatoes. In an inductive process, these issues are taken as entry points for exchanges with stakeholders on how plant health management is currently practiced in organic systems and how they would like to see it managed. In parallel, the discursive and reflexive process is informed by literature reviews undertaken by a participating researcher based on key words that emerge in the exchanges with practitioners.

**Results:** Seeds circulating within community seed networks do not always conform with official requirements for seed health in Europe, such as plant health regulations and requirements for certified seed. Firstly, the necessary seed testing to ensure the absence (or threshold) of seedborne plant pathogens are often inaccessible to communities managing larger crop collections, for practical and financial reasons. Secondly, actors within the communities do not necessarily aim at conforming with these requirements, as they aspire to a more holistic management of plant and seed health embedded in local environments, including microbial communities and management practices (Klaedtke, 2017).

Holistic approaches to plant health base health on the interactions that plants have with their microbial communities, usually in organic growing environments. This involves practices aiming to strengthen plant defenses and adaptation and cropping systems' resilience and to benefit from the role of complex microbial communities in soils and above-ground as antagonists to plant diseases. As this approach is practiced in the field, it may also involve interpreting plant diseases as indicators of an imbalance in the growing environment (Klaedtke et al., 2017). More basic life science research published in recent years increasingly supports approaches grounding plant health in complex microbial environments associated to plants (e.g. Vayssier-Taussat et al., 2014), be it in the rhizosphere, the phyllosphere or on seeds. The importance of local environmental conditions and epigenetic mechanisms (e.g. Bertschinger et al., 2017) are also receiving increasing attention.

Publications from social sciences and more interdisciplinary fields also feed into emerging debates as theoretical resources and food for thought. For instance, Döring et al. (2012) have identified and described a wide range of different, sometimes mutually exclusive, approaches to plant health. The type of approaches that organic communities adopt have implications both on future research agendas for farm-level agroecosystems and seed systems, and on their ability to overcome dependence on external inputs, as emphasis can be put on substituting chemical inputs with bio-inputs or on resilient farming and seed systems to ensure plant health (Levidow et al., 2014).

**Discussion:** These considerations, which have emerged among some actors of crop diversity in Europe, mostly in organic systems, are relevant for the broader organic sector: How do we define plant and seed health from an organic perspective? Accordingly, what role do microbial communities play as buffers facilitating plant health? Are plant pathogens to be absolutely excluded from organic systems, or can they form part of healthy growing systems within complex microbial communities?

Engaging with these questions implies situating plant and seed health management practices among the ranges of possible approaches, as well as discursive processes among actors of organic agriculture to define desirable approaches to plant health, both at the level of communities and local production and at larger collective scales. It also involves identifying blind-spots in current science in order to develop future research able to inform a diversity of approaches to plant health.

**References:** Bertschinger L, Bühler L, Dupuis B, Duffy B et al. (2017): Incomplete Infection of Secondarily Infected Potato Plants—an Environment Dependent Underestimated Mechanism in Plant Virology. *Frontiers in Plant Science* 8

Döring TF, Pautasso M, Finckh MR & Wolfe MS (2012): Concepts of plant health - reviewing and challenging the foundations of plant protection. *Plant Pathology* 61(1): 1–15

Klaedtke S (2017): Governance of plant health and management of crop diversity - the case of common bean health management among members of the association Croqueurs de Carottes. <http://orbi.ulg.ac.be/handle/2268/209569>

Levidow L, Pimbert M & Vanloqueren G (2014): Agroecological Research: Conforming—or Transforming the Dominant Agro-Food Regime? *Agroecology and Sustainable Food Systems* 38(10): 1127–1155

Vayssier-Taussat M, Albina E, Citti C, Cosson JF et al. (2014): Shifting the paradigm from pathogens to pathobiome: new concepts in the light of meta-omics. *Frontiers in Cellular and Infection Microbiology* 4

**Image:**



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