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## Control of seed borne diseases in organic seed propagation.

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### Introduction

The key control measure of plant diseases in organic agriculture is crop rotation, mixed cropping and moderate fertilization. A wide range of plant diseases can be controlled or minimized in this way. However, at least one group of plant diseases, the seed borne diseases, cannot. The seed borne diseases are not transmitted through the soil, and crop rotation is therefore an insufficient tool. Mixed cropping is impractical in seed propagation, where seed purity according to the seed legislation is imperative. The fertilization level primarily has an impact on facultative saprophytes, and not on the specialized seed pathogens.

Seed borne diseases were the first plant pathogens to be controlled by pesticides. Heavy metals has been used as seed treatments for more than 200 years, and for almost 100 years, the seed borne diseases has been controlled exclusively and very effectively by chemical seed treatments. On this background, research in control of seed borne diseases has had practically no priority in research programs during the last century. Compared with other agricultural topics, the control of seed borne diseases in organic agriculture therefore suffers from the largest lack of knowledge, as we are 100 years behind in research.

International seed legislation does with a few exceptions not define minimum quality standards for seed infections with pathogens, as seed sold on the international market normally are treated with fungicides. Surveys show that for some crops, the nationally recommended thresholds for seed pathogens are regularly exceeded in organic seed-lots, and some years the majority of organic seed lots are discarded due to seed borne diseases in propagation systems, where seed health is assessed on a routine basis. To ensure the availability of organic seed for the organic farmers, control measures for seed borne diseases are imperative, and an international system to ensure seed health in organic seed lots should be implemented.

Methods to control seed borne diseases in organic agriculture exist. Resistant varieties exist in many cases, and could be used to a wider extent. Different heat treatment can control most seed borne diseases, and new technologies can make this opportunity practical to implement. Technology to separate seed exists, and could be used as a tool to promote the propagation of seed in mixed cropping systems to decrease plant pathogens, including seed pathogens in propagation. Heavy and large seed are generally less infected than small and light seed. The separation and removal of the latter can therefore reduce the infection level in a seed lot. Some seed amendments of natural origin can be used in organic agriculture to replace synthetic pesticides.

### Ongoing projects

Agrologica is currently involved in several projects on control of seed pathogens. This includes

- 1) heat treatments of cereals by drum-dryer, (*Pyrenophora teres*, *Tilletia tritici*, *Ascochyta pisi*, *Fusarium* spp)
- 2) heat treatments of vegetables seed with steam and ultrasound, (*Altanaria radicina*, *A. petroselini*, *Cladosporium* sp, *Septoria Petro*, *Stemphylium* spp, *Phoma lingam*, *Botrytis* spp, *Xantomonas compestris*)
- 3) seed dressings, including plant extracts, smoke, natural chemicals and biological control,
- 4) physical cleaning of seeds to remove pathogens and infected seeds from seed lots (*Ustilago nuda*, *Pyrenophora graminea*, *P. teres*, *T. tritici*, *Fusarium* spp).
- 5) integrated control of common bunt (*T. tritici*) in spelta-wheat (*Triticum spelta*),
- 6) preventive cropping methods to reduce build-up of pathogenic fungi during propagation (mixed cropping, early harvest),
- 7) determining threshold values for organic cereals related to the susceptibility of the individual varieties (*P. graminea*, *P. teres*, *T. tritici*, *Ascochyta* spp, *Fusarium* spp).

### Conclusions and recommendations

Research during the last two decades has shown that progress can be achieved and that solutions exist. Based on this, it can be concluded that seed borne diseases can be controlled in organic agriculture. However, extension and research to refine methods are urgently needed to do so.