STOVE

A Project about seed treatment for organic vegetable growing

Until the end of 2003 seed derived from conventional agriculture could be used in organic production. Based on a directive of the European Union this is not allowed anymore. Seed for organic production must itself be produced organically. This can cause problems if the desired seed is not available, or only available with impaired quality.

A common reason for impaired quality is external or internal contamination with bacteria and fungi that affect plant stand or lead to a diseased crop. Whereas in conventional vegetable production chemical seed treatments are allowed that control or reduce at least the fungal pathogens, organic seed producers and vegetable growers have hardly any effective method for seed sanitization at hand.

Project description

The aim of the EU-financed research project „STOVE“ (Seed Treatments for Organic Vegetable Production) is to evaluate different methods potentially suited for seed treatment of vegetables in organic farming regarding their efficacy, to optimise these methods, and where feasible to combine them with each other. Scientists from seven European research institutions and a producer of organic vegetable seeds carry out the project.

Three physical methods (hot water, hot humid air and electron treatment) and different biological applications are being investigated. Treatment with warm or hot water has in the past been quite frequently used for sanitization of contaminated cereal seeds. Treatments with hot, humid air and electron seed treatment have been developed for the same purpose. In cereals these methods are currently in the introductory phase or already in practical use.

The biological applications comprise for example plant extracts, inducers of resistance and microbial preparations. Some of these agents are marketed for other uses, e.g. control of foliage diseases, but so far it is not known, if they are also effective against seed-borne diseases.

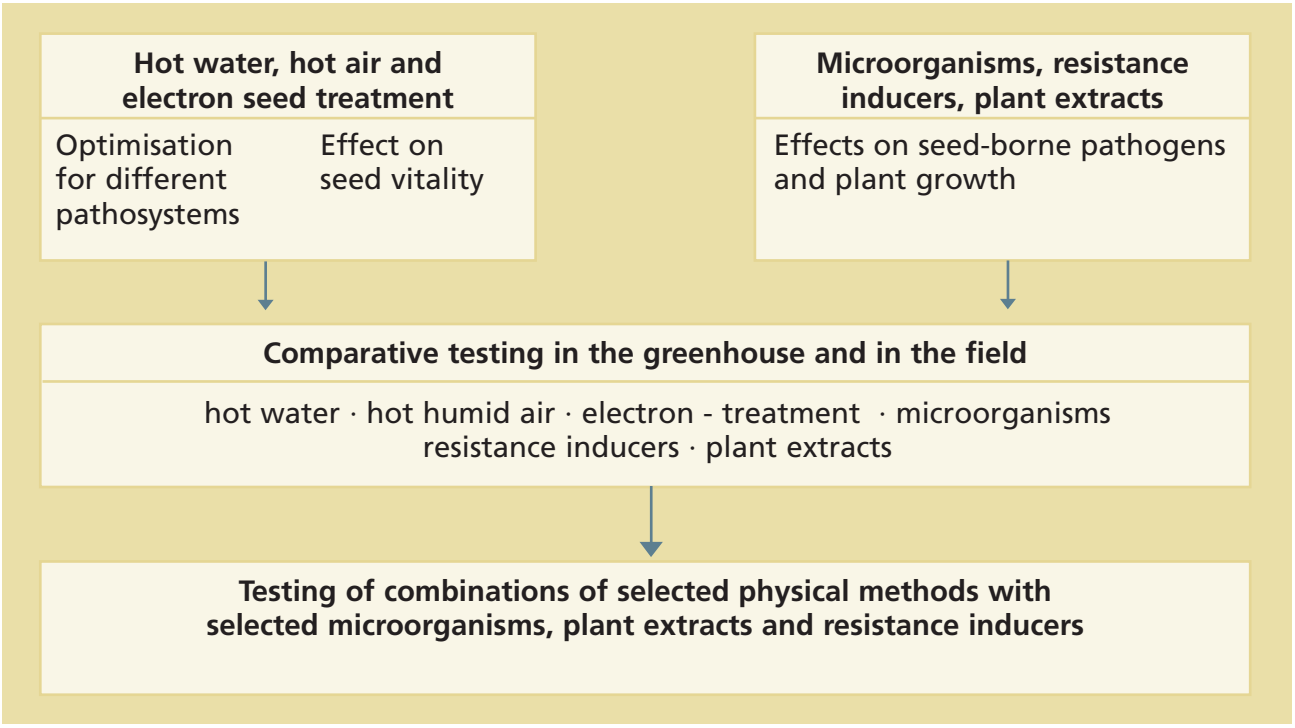
Trial methodology

Studies on seed-borne diseases require sufficient quantities of seeds naturally infected to high percentages with the respective pathogens. The vegetables / pathogens selected (see table) were therefore mainly determined by the available seeds. But even a clearly diagnosed high percentage of seed infection cannot guarantee that the disease actually develops. Often, certain environmental conditions, like prolonged periods of wetness are needed to allow transmission of the pathogen from the seed to the plant parts aboveground.

The properties of the diseases play an important role for the lay out of the experiments and evaluation of the disease. For example, in case of the carrots seeds contaminated with *Alternaria*-fungi or lamb`s lettuce infected with *Phoma* efficacy of the seed treatments can be well evaluated in seed trays in tests under controlled conditions: infested seeds do not germinate, or the seedlings show damping-off.

In case of *Septoria*-leaf spot of parsley execution of the experiments is more difficult because the seed infection has no effect on the health status of the seedling. Therefore, the efficacy of seed treatments against this disease can only be assessed in field experiments based on leaf symptoms.

The situation is even more complicated with the bacterial diseases. In practice, a few infected plants can be the starting point for massive disease, especially with transplanted crops like cabbage. Therefore, the threshold for the tolerable degree of infestation of seeds can be 0.01% or even lower. The seeds



Main vegetable seed lots used in the project

Species	Pathogens present on the seeds	Diseases caused
Carrot	*Alternaria dauci* and *Alternaria radicina*	Leaf blight and black rot
Carrot	*Xanthomonas hortorum* pv. *carotae*	Bacterial blight
Parsley	*Septoria petroselini*	*Septoria*-leaf spot
Cabbage	*Alternaria brassicae*	Dark leaf spot
Cabbage	*Xanthomonas campestris* pv. *campestris*	Bacterial black rot
Lamb`s lettuce	*Phoma valerianellae*	*Phoma* damping off
Bean	*Colletotrichum lindemuthianum*	Anthracnose
Pea	*Ascochyta pisi*	Pea blight, pod spot

used in our study had an infestation level of 0.18%. Nevertheless, even with a high percentage of transmission from the seeds to the foliage with this seed lot experimental batches of several thousand seeds would be required to get significant results concerning the protective effect of the applied seed treatments. Because of this, indirect methods (e.g. detection of the causal agents in leaf washings by plating on selective agar media) were included in the experiments with *Xanthomonas*-infected carrot and cabbage seeds.

Physical methods – effective, but not without problems

One aim of the project was to adapt the treatment parameters of the physical seed treatment methods mentioned above to different vegetable species and to optimise their effect on the pathogens. For most of the host-pathosystems studied effective physical treatment variants were identified. However, all physical methods have in common that they may have adverse effects on the seeds if applied at too high intensity. As a result, germination may decrease instead of increase. Because the sensitivity of seed lots varies even within the same vegetable species, there is no „standard treatment“.

In order to find out the optimum treatment for a given seed batch, pre-tests with germination assays are necessary.

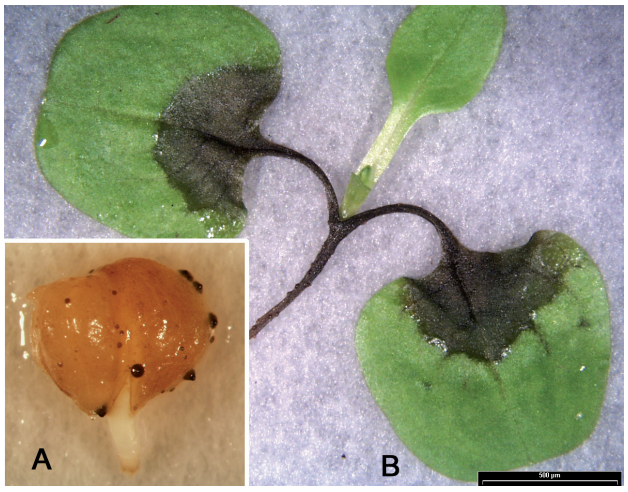
Experiments specifically designed to study the effect of seed maturity showed that the latter has a strong influence on the sensitivity of the seeds. In these experiments cabbage seeds were sorted based on their colour (the browner the seed coat the more mature the seed) into different maturity fractions, which were then exposed to hot water, hot humid air or electron treatment. Afterwards, the germinability was determined. The results clearly showed that the seeds reacted to the hot water and hot humid air treatment the more sensitive the more immature they were.

Biological treatments – more efficacious in the greenhouse than in the field ?

In the greenhouse tests suitable biological treatments were identified for some of the studied vegetable-pathosystems. They included agents from all categories, i.e. plant extracts, microorganisms and inducers of resistance.

Most of the results still require confirmation under field conditions, but the data available so far indicate that the efficacy of the biological treatments is often better in the greenhouse than in the field. In contrast, performance of the physical treatments under controlled conditions and in the field appears to be largely comparable.

A. Spore-forming structures of the ***fungus Phoma*** *valerianellae on the surface of a germinating lamb`s lettuce seed.*
B. Lamb's lettuce seedling killed by seed-borne infection with ***P. valerianellae***



STOVE

Seed Treatments for Organic Vegetable Production

Facts on STOVE

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Participants

Dr. Eckhard Koch, Dr. Annegret Schmitt, Petra Zink, Dr. Marga Jahn, Dipl. Biol. Carola Kromphardt
Federal Biological Research Centre for Agriculture and Forestry, Institute for Biological Control and Institute for Integrated Plant Protection

Dr. Steven P.C. Groot, Dr. Jan. M. van der Wolf and Mrs. Patricia van der Zouwen, Plant Research International, Wageningen, The Netherlands

Dr. Sandra Wright, Dr. Tahsein Amein, Göteborg University, Sweden

Dr. Mariann Wikström, Dr. Rolf Stegmark, Findus R&D, Sweden

Dr. Sigrid Werner, HILD Samen GmbH, Germany and Dr. Jan van den Berg, Nunhems Zaden, The Netherlands

Dr. M. Lodovica Gullino, Dr. F. Tinivella, AGRINNOVA, Italy

Dr. Steve Roberts, HDRA, Ryton Organic Gardens, UK

Sub-contractors

Dr. G. Forsberg, SEEDGARD AB, Sweden
Dr. H. J. Krauthausen, DLR Rheinpfalz, Germany
Dr. Ing. Olaf Röder, Fraunhofer Institut, Germany

Co-ordination

Dr. Eckhard Koch & Dr. Annegret Schmitt
Federal Biological Research Centre for Agriculture and Forestry, Institute for Biological Control, Heinrichstr. 243, D-64287 Darmstadt
E-mail: e.koch@bba.de, a.schmitt@bba.de

Homepage

For further information, please see the project homepage at http://www.stove-project.net/

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