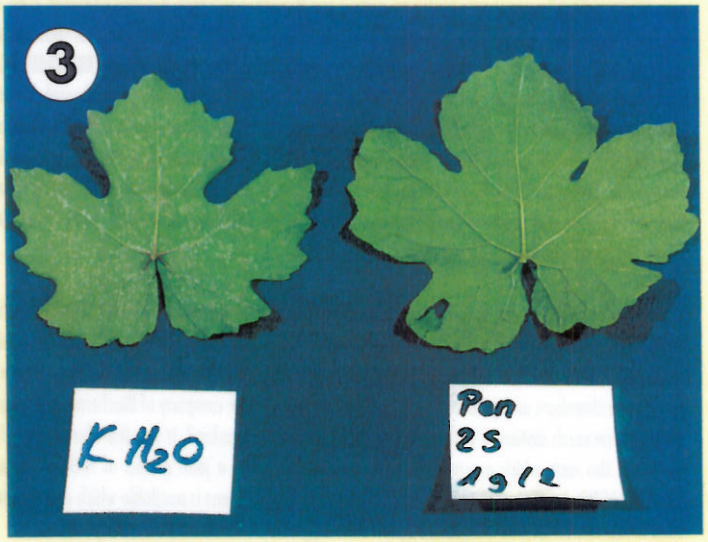

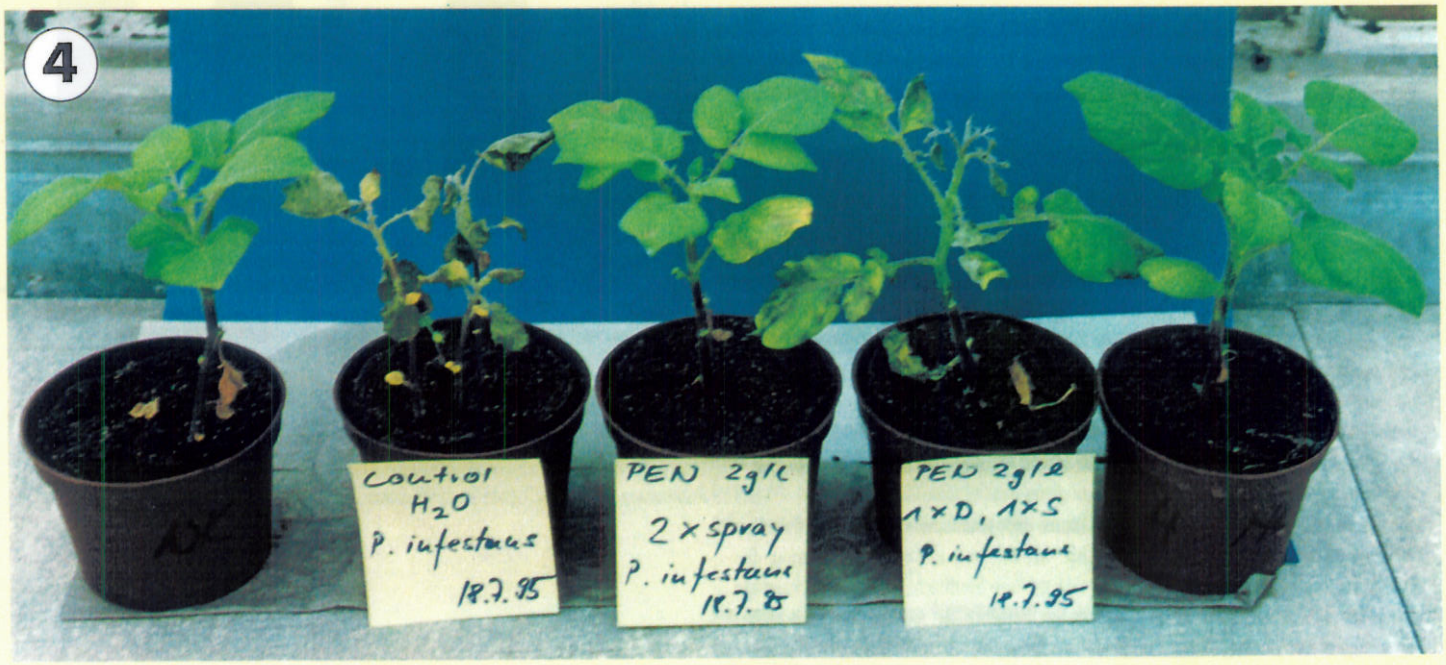

Fertilization with BIOSOL® improves plant health

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BIOSOL®, an organic fertilizer produced by BIOCHEMIE Ges.m.b.H. in Kundl Austria is known to many forestry experts and farmers in Austria and far beyond. The excellent fertilizer properties of **BIOSOL®** have been repeatedly verified by scientific papers. A special advantage is the slow nitrogen release from the dried fungal mycelium, which is the starting material for Biosol production. The slow release of nitrogen, which is mainly present in proteious form, prevents leaching and overdosage. The last two properties even permit the use of **BIOSOL®** in protected water collection areas and organic farming. When used over a period of several years, considerable improvements of the soil structure and soil biology will result combined with lasting, positive effects on forest cultures, ski slopes and agricultural crops.

Many users and some scientific studies gave rise to the impression that plants which are fertilized with **BIOSOL®** are not only better nourished and therefore stronger, but also healthier. Even an increased resistance to fungal diseases has been observed repeatedly. The occurence of snow mould was considerably reduced in exposed areas of ski slopes which were fertilized with **BIOSOL®**. With regard to vine growing, an increased resistance of vines to the most dangerous fungal diseases was statistically proved by Dr. Solar, University of Soil Sciences, Vienna during a field trial carried out over many years. It is possible to prove and explain such conspicuous observations in scientific terms? Do we not usually observe the opposite, namely that good or too intensive nitrogen fertilization increases the susceptibility of cultures to fungal diseases ? The secret seems to be in the composition and production of **BIOSOL®**.

In order to be able to prove and explain the assumed plant protective action of **BIOSOL®**, infections have to be produced in plants which were treated with **BIOSOL®** or are untreated under strictly controlled conditions. Such conditions for cultivation and infection are routinely available in the climate chambers and greenhouses of SANDOZ AGRO, a sister company of Biochemie, in its agrobiological research station in Witterswil, canton Solothurn, Switzerland. It was therefore practical to carry out the tests which are necessary for argumentation in a joint project of BIOCHEMIE and SANDOZ AGRO. In Witterswil, a large collection of fungal pathogens is available which are normally used in the search for new fungicides due to their aggressiveness and economic importance.

Two of these pathogens were selected for the **BIOSOL®**-project, one of which is Phytophthora infestans, the pathogen causing late blight of potato. This noxious fungus, which also occurs on tomatoes, increasingly causes problems for potato farmers in recent years, as new strains occur which are resistant to the common fungicides. This is why Phytophthora is an important target organism for SANDOZ AGRO. Plasmopara viticola, the pathogen of the downy mildew of grapevine, was used as test object for diseases of vines.

The following is a brief description of the standardized trial procedure: an aqueous extract was prepared from the fungal mycelium which is the raw material for the production of **BIOSOL®** using heat and pressure. This extract is clarified by simple filtration and contains polysaccharides (= multiple sugars) of different lengths and proteins as major components. The extract has the brown color and typical odor of **BIOSOL®**.

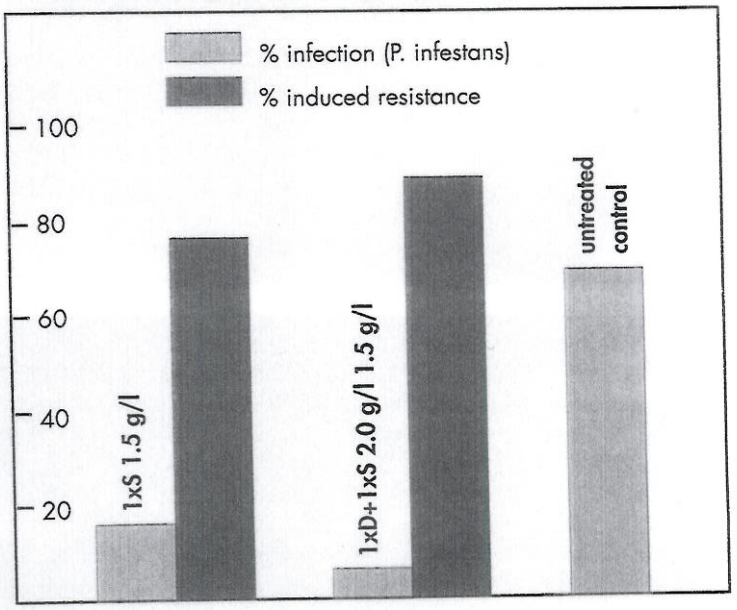
When young potted tomato plants are watered with this fungal extract, the strong fertilizer effect know from **BIOSOL®** can be seen already after a few days. The plants are larger, they have thicker stems, a larger leaf surface, and a dark-green healthy color due to the higher chlorophyll content. The gardeners in the greenhouse nicknamed these plants „Schwarzenegger tomatoes". Too high dosage causes phytotoxic reactions.

When the potted plants are watered twice with the **BIOSOL®** extract, preferably seven and three days before infecting the plant massively with the pathogen Phytophthora infestans, the effect is highly positive. One week after the strong artificial infection, when leaves which are highly infected with the fungus already fall off the untreated control plants, the tomatoes which have been watered with mycelium extract still look very well and only show a few small infected spots. This experiment, which has been repeated many times, is the first irrevocable proof of the assumed plant protective action of **BIOSOL®**.

A second result came as a surprise: the protective action is still improved, if the tomato leaves are sprayed during the second treatment instead of watering the plants once again. The symptoms on the **BIOSOL®** plants are then reduced by 85 to 95 % as compared to the untreated and equally infected control plants (figure 1 and 2). The same observations were made with regard to the late blight of potato (see fig. 4). In this case however, spraying twice, seven and three days before the first infestation, was more successful than the combined watering/spraying treatment. The same was applicable to young vine cuttings which were infected with Plasmopara viticola; two preventive spraying treatments with fungal extract made the plants 90 % resistant to fungal attack (see fig. 3). It is important that treatment is started in time before the first fungal infection, because the **BIOSOL®**-extract does not actually kill the fungus. This was also proved by laboratory tests, as fungi can even grow on the extract.

These last observations help to explain the surprising phytosanitary effect of **BIOSOL®**. The fungus is not actually killed by the mycelium extract, but **BIOSOL®** improves the resistance of plants to the fungal attack. This is clearly a case of induced resistance. This phenomenon had been known to the scientists in Witterswil for a long time, and for many years they have searched for a natural trigger of this self-defense of cultivated plants. It is present to the aqueous extract of penicillium mycelium, which is processed at BIOCHEMIE in Kundl to produce **BIOSOL®**.

Strengthening of the Resistance of Tomatoes against Phytophthora infestans



Treatment with BIOSOL®-extract (left 1x, middle 2x) and untreated control (right).

Photos on the back:

1. and 2. (detail) Tomatoes – Infected control, untreated (left) and infected plant, treated with BIOSOL®-extract (right). 3. Vine – Infected control, untreated (left) and infected plant, treated with BIOSOL®-extract (right). 4. Potatoes – Control, not infected (left); control, infected and untreated (2nd left); infected plant, optimal treatment with BIOSOL®-extract (middle); infected plant, suboptimal treatment with BIOSOL®-extract (2nd right) and control, not infected (right).