



Peronospora/Downy mildew

Downy mildew in soybeans is one of the most widespread leaf diseases in soybean cultivation. Although partially defoliation occurs during infestation, yield losses are extremely rare. Hartmann et al. (2008) report a yield loss of approx. 8 % for a *Peronospora* infestation.

Downy mildew in soybeans is caused by the fungus *Peronospora manshurica*. This disease occurs worldwide wherever soy is cultivated. Yield is only affected in exceptional cases (University of Minnesota, 2014; University of Delaware, 2014; North Central Soybean Research Program, 2014). However, seed quality may suffer if the seeds are infested by downy mildew.

Symptoms

The symptoms appear at the beginning of flowering on young leaves. Dew and high air humidity combined with moderate temperatures promote the occurrence of the fungus. Initial symptoms are small greenish to



Fig. 2: *Peronospora* spots on soy (Taifun, 2014).

yellow spots on the leaf surface of young leaves (Fig.1). With increasing age the spots grow and become brownish with a yellow edge (Fig.2). The underside of the leaf often shows a greyish fluff, which distinguishes downy mildew from other diseases. Heavily infested leaves turn completely brown and fall off. If the seeds are infested, they are covered by a whitish hyphal network (University of Minnesota, 2014). An infection of the seeds can also occur without visible signs on the pod. The infected seeds can be smaller and lighter than healthy seeds and usually lead to systemically infected seedlings which show symptoms after about 2 weeks. The symptoms includes light green areas on the young leaves, which spread fan-like along the leaf veins.



Fig. 1: *Peronospora* spots on soy leaves (Taifun, 2014).

Control strategy

Since a yield loss is very rare, the use of fungicides should not be considered - especially since there are no authorized products in Germany. To minimize the risk of infestation, it is essential to use healthy, certified seeds and not to use seeds from infested plants. Since the fungus survives on crop residues, they must be buried deeply during soil cultivation. As soy is the only host plant of *Peronospora manshurica*, it is important to maintain a three-year crop rotation (AGES, 2014). There are also more or less susceptible varieties and even resistances to downy mildew (Chowdhury et al., 2002).

Biology of the pathogen

The hyphae of *P. manshurica* are present intercellularly in the host tissue. The leaf surface is reached via the stomata. Oospores are light brown or yellow and have netlike walls. Germination takes place through the formation of a germination tube. Zoospores are not generated. Haustoria are formed by intercellular mycelium and can branch up to five times within a cell (Phillips, 1975).

Life cycle

P. manshurica winters as oospores in leaves or on seeds. The oospores attack the soy seedlings. Seeds encrusted with oospores can produce systemically infected seedlings at cool temperatures (Phillips, 1975). The infection spreads via lesions along the main vein of the first leaf. Under humid weather conditions, conidiophile hyphae and conidia form on the underside of the leaves (Riggle, 1974). With increasing humidity, the conidia are released and transported by the wind to other plants (Pederson, 1961), where they germinate again and penetrate the young leaves via the epidermis. High humidity and temperatures of 20-22°C favor growth and spreading. Sporulation takes place at 10-25°C (Phillips, 1975).

Sources

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