Field assessment of the influence of a seed treatment with the antagonistic bacterium *Serratia plymuthica* on the control of major rapeseed pathogens in *Brassica napus*

The efficiency of a seed treatment of oilseed rape (*Brassica napus*) with the antagonistic rhizobacterium *Serratia plymuthica* (strain HRO-C48) against blackleg disease caused by *Phoma lingam*, *Verticillium longisporum* and *Plasmodiophora brassicae* was tested separately and in combination with azole fungicides in perennial field trials at nine sites in northern Germany. Furthermore, the performance of HRO-C48 against *V. longisporum*, *P. brassicae* and *S. sclerotiorum* was examined in glass house trials.

Seeds were enriched with bacteria via bio-priming ($\log_{10}$ 6 CFU seed^{-1}). Occurrence and severity of *P. lingam* leaf infestation, stem and crown canker was highly variable depending on the year and field site. No correlation between leaf infestation and crown canker infestation was recorded. Reductions of *P. lingam* infestation frequency (6-19%) and leaf pycnidia area under disease progress curves (AUDPC) (17-70%) provided by the single HRO-C48 treatment were significant in 1 out of 7 cases compared to the untreated control in the first year of trials (2008/09). In combination with fungicides the effect was slightly higher, leading to reductions of infestation frequency (11-26%) and leaf pycnidia AUDPC (38-78%), which were significant in 2 out of 7 cases. In the following years the level of *P.lingam* leaf infestation was lower and there were no significant reductions provided by the single HRO-C48 treatment. Disease score, pycnidia and infestation frequency of weaker infestations with crown canker was controlled significantly by the bacterium and the combined treatment of azol fungicides and bacteria at 3 out of 7 trial sites in the first season, whereas the single fungicidal treatment could not provide significant reductions. More severe crown canker infestations recorded during the last season of trials (2010/11) were not reduced by HRO-C48, whereas fungicide treatment even enhanced the severity in 6 out of 7 cases in this trial year. Treatments led to in increased yields in 2008/09, whereby the combined treatment of bacterium and azoles resulted in a surplus of 1.5 dt ha^{-1} in average. During the following trial seasons treatments had only minor impact on yield. In general, differences within the yields were not significant.

S. plymuthica was able to colonize the rhizosphere of the rapeseed plants efficiently ($\log_{10}$ 6 - 7 CFU/g rhizosphere) at all trial sites and years. The population dynamics were influenced by different soils and climatic conditions and effective bacterial densities during the whole growing period often dropped below the minimum effect level in winter/spring, what might have been the reason for insufficient control effects of the antagonist.

During the investigation period *V. longisporum* naturally occurred in 16 out of 21 field trials leading to infestation frequencies as high as >70 % at several sites. Summarized results for *V.longisporum* control, including all sites and trial years, revealed remote differences within the non fungicide treated variants, while fungicide treated variants showed an increased infestation compared to the control and a significant higher infestation compared to the single bacterial treatment. Cultivar dependent control effects reported by previous investigations against *V. longisporum* in glass house trials could not be confirmed with the cultivar Visby used for field trails and other cultivars tested also in glasshouse trials. Field and glasshouse trials demonstrated that HRO-C48 is not able to reduce *P. brassicae* infections at common levels of spore concentrations. The resistance of the cultivar Mendel was confirmed. In glasshouse trials the antagonist reduced size of lesions caused by artificial inoculated *Sclerotinia sclerotiorum* significantly.