Enhancement of biological control properties naturally present in soil

Joeke Postma & Mirjam Schilder

Introduction
Rhizoctonia solani is a soil-borne fungal pathogen which causes serious losses in many different agricultural crops. Enhancement of soil suppressiveness against this pathogen would be a profitable strategy for farmers. Previous research had shown that three closely related Lysobacter spp. were present in Rhizoctonia suppressive soils. Therefore, compounds which are expected to stimulate these bacteria were tested for their efficacy to enhance disease suppression.

Experimental set up
Different organic compounds (0.3 % g dry weight/g soil) were added to a marine clay soil, which was known to contain antagonistic Lysobacter spp. The soil was mixed and incubated for 1 week at room temperature. Thereafter, soil suppressiveness was tested in a bioassay with sugar beet seedlings and R. solani AG2.2IIIB under controlled climate and soil moisture condition. Lysobacter spp. were quantified with TaqMan®, a real-time PCR procedure. Effective organic compounds were also assessed in several other soils.

Results
Enhanced disease suppression of R. solani AG2.2IIIB in sugar beet occurred after the amendment of soil with chitin and several protein-rich animal waste products, such as feather, hoof, blood, meat and fish meal. Plant derived waste materials were not effective. Disease suppression could be stimulated in different soil types. In general, Lysobacter populations were significantly enhanced in the suppressive treatments.

Practical application
The price of feather and hoof meal allow application in arable crops. Both are applied as fertilizer in organic agriculture. The efficacy of these compounds to enhance disease suppression will be further studied in the field under practical conditions. The organic waste compounds can be applied (1) as fertilizer with Rhizoctonia suppression as positive by-effect, or (2) in an optimized procedure to control Rhizoctonia.

The suggested application of animal by-products will enhance sustainable soil management by employing the naturally present beneficial microbial populations, meanwhile contributing to recycling of waste streams.