

*Emmanuelle Noirtin*  
Paul Cavell, Martin  
Benninger

BASF France Agro, Ecully,  
France

Integral® Pro is a new tool for protecting oilseed rape complementary to standard chemical crop protection programmes. It is based on *Bacillus amyloliquefaciens*, strain MBI 600, formulated as uncolored flowable concentrate for seed treatment (FS). A content of at least  $2,2 \times 10^{10}$  colony forming units (cfu) per ml is guaranteed. Application rate is 160 ml per 100 kg seed. Integral® Pro is registered as plant protection product in many European countries.

Integral® Pro is effective against soil pathogenic fungi (except Pythiaceae), which are responsible for damping-off, and especially against *Phoma lingam* (*Leptosphaeria maculans*) and triggers mechanisms of stimulation of natural defenses leading to vigorous plants and to a reduction of flea beetle damage (*Psylliodes chrysocephala*, *Phyllotreta* sp; under low to medium pressure).

Integral® Pro has multiple modes of action:

- Root colonization creating a barrier against fungi. Growing colonies of *Bacillus amyloliquefaciens* bacteria are able to move along growing roots forming a dense biofilm (consortium of microorganisms attached to a surface such as roots). This process effects physical exclusion by excluding other non-beneficial bacteria and fungi, either on seed or root surface as well as nutrient competition, also by excluding other non-beneficial bacteria and fungi.
- Anti-fungal compound production. Integral® Pro produces Iturin and Surfactin. These compounds work by preventing disease growth and disease spore germination. The production of antifungal compounds causes a zone of exclusion, where diseases cannot grow, and disease spores cannot germinate.
- Plant defense stimulation. Integral® Pro works by activation of Systemic Acquired Resistance (SAR) and Induced Systemic Resistance (ISR). The activity of *Bacillus amyloliquefaciens*, MBI 600 as elicitor of SAR or ISR pathways in seed treatment was measured by the expression of the both SAR and ISR pathways marker genes by qPCR.

The nature and multiple modes of action makes Integral® Pro a complementary tool of integrated pest and disease management programmes.