



# Integral<sup>®</sup> Pro

The first biofungicide seed treatment for oilseed rape

**BioSolutions by BASF**

[www.agro.basf.com](http://www.agro.basf.com)

# A NEW GENERATION OF SEED TREATMENT



Improved plant  
establishment



Disease  
reduction



Reduction of  
damage caused  
by flea beetle



Maximized  
yield potential

Integral® Pro provides a **new and sustainable** approach to **protect** and **strengthen** oilseed rape via **three modes of action**, helping to **maximize** genetic potential.

# IMPROVED PLANT ESTABLISHMENT

## SECURE YOUR CROP FROM THE VERY BEGINNING

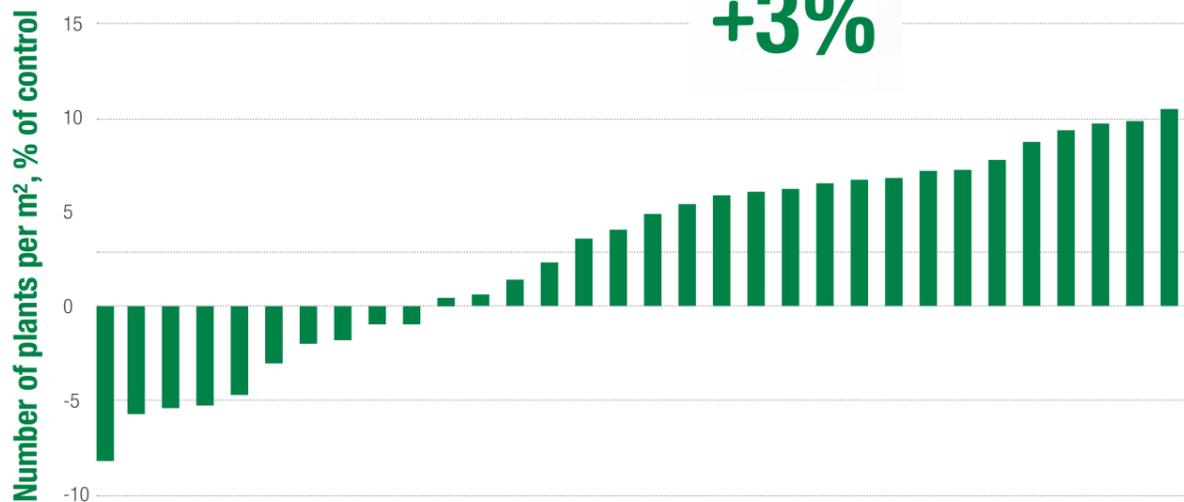
Integral® Pro boosts the development and establishment of oilseed rape at a very crucial stage. Interactions between the young plants and the product, allows each plant to reach its full genetic potential.

Integral® Pro strengthens oilseed rape plants right from the beginning. Results from an extended network of field trials performed all-over Europe demonstrates the positive impact of Integral® Pro at a very critical stage: **plant emergence.**



Performance of Integral® Pro in combination with standard fungicide seed treatment

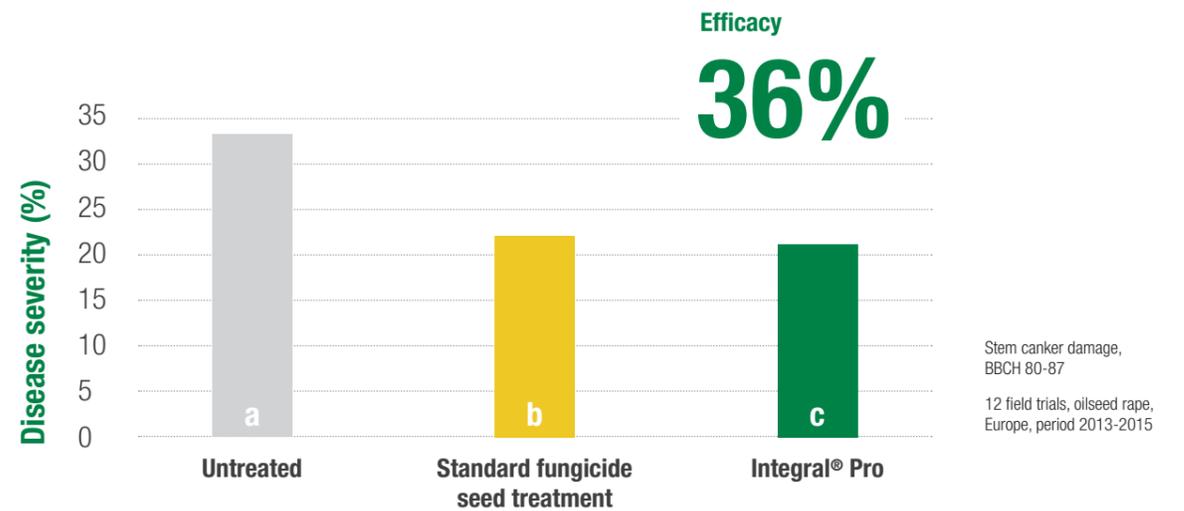
Plant establishment  
**+3%**



Comparison between standard fungicide seed treatment and standard fungicide seed treatment + Integral® Pro, number of plants per m²/ relative percentage, BBCH 10-11, 32 field trials, oilseed rape, Europe, period 2013-2015

# DISEASE REDUCTION

## BIOFUNGICIDE ACTIVITY



Due to its fungicidal properties, Integral® Pro helps **reduce damage** caused by fungi as well as standard seed treatment.

Field trial results show that Integral® Pro is as effective as some standard chemical fungicide seed treatments against

**Phoma lingam.**



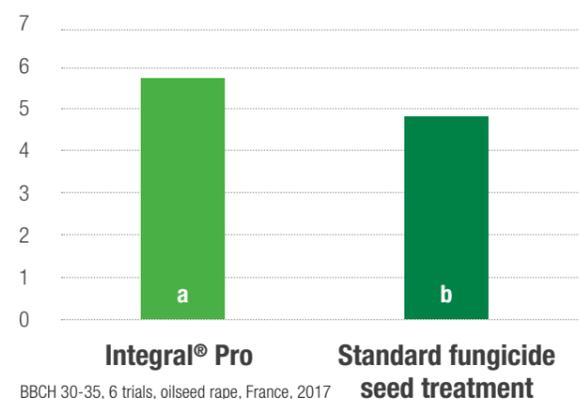
# REDUCTION OF DAMAGE CAUSED BY FLEA BEETLES

## SUPPLEMENTARY TOOL FOR FARMERS

Despite the absence of direct effects on insects, Integral® Pro reduces the damage caused by flea beetles in field trials. Integral® Pro is a new supplementary tool for managing flea beetle attacks in combination with integrated pest and disease crop protection programs.

Due to its specific mode of action, Integral® Pro strengthens the oilseed rape plants not only during early plant development, but also during the winter season. Consequently, oilseed rape plants are more vigorous once the vegetation period starts in spring.

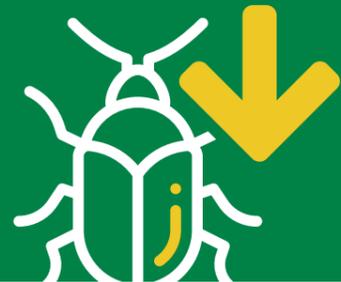
### Vigor after wintering



Due to the emergence in some countries of resistance to pyrethroid insecticides, and in the absence of insecticide seed treatment, new innovative solutions are needed.

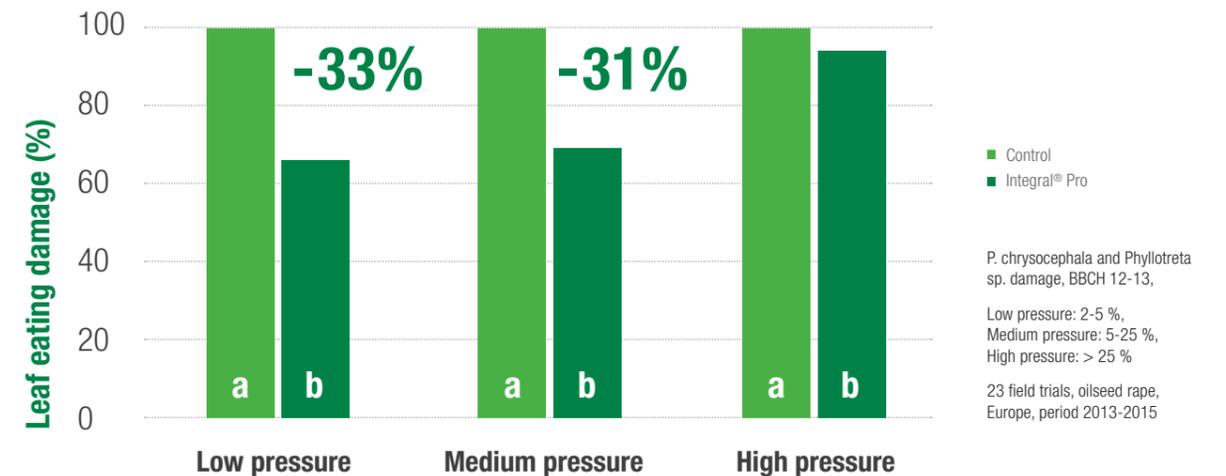
Integral® Pro is one of them.

**More robust plants.**



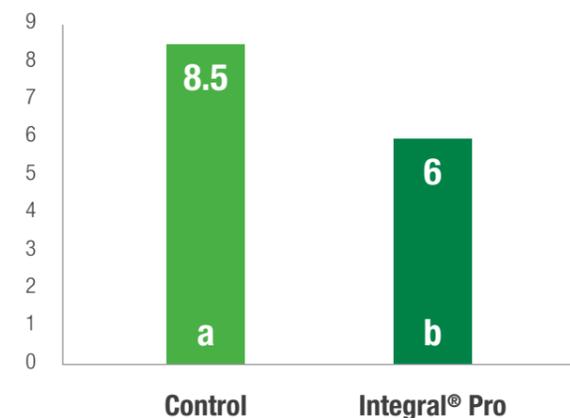
**INTEGRAL® PRO STRENGTHENS THE OILSEED RAPE PLANTS. THEY ARE LESS SENSITIVE TO FLEA BEETLE ATTACKS. A COMBINATION THAT ALLOWS THE PLANTS HEALTHY GROWTH.**

## Reduction of flea beetle damage under different pest pressures



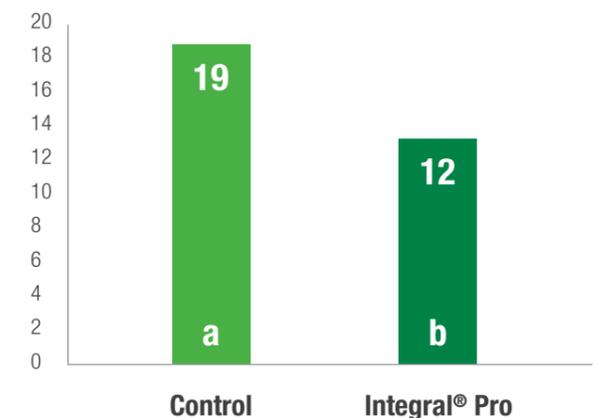
### Leaf damage reduction

Leaf eating damage (%)



### Larvae reduction

Number of larvae per 10 plants



**30% efficacy against flea beetles under low to medium pest pressure**

# INTEGRAL® PRO

## WHAT IS INTEGRAL® PRO?

Integral® Pro is a seed dressing for the protection of oilseed rape against *phoma* and for the stimulation of natural defenses. With the help of this product, bacteria develop in the root zone of the oilseed rape seedling, which will protect the plant in the long term. Integral® Pro is registered in all key oilseed rape growing countries in Europe.

THE GROWTH  
PROCESS CAN BE  
PROTECTED AND  
PROMOTED IN AN  
OPTIMAL WAY

## WHY INTEGRAL® PRO?

Integral® Pro is effective against soil pathogenic fungi, which are responsible for damping-off, and especially against *Phoma lingam* (*Leptosphaeria maculans*). Integral® Pro 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).

## PRODUCT DESCRIPTION

- *Bacillus amyloliquefaciens*, **MBI 600**
- Uncolored
- Flowable **concentrate** for seed treatment (FS)
- At least **2.2 x 10<sup>10</sup>** colony forming units (cfu) per ml
- Application rate: **160 ml** per 100 kg of seed
- **Compatible** with standard products used on oilseed rape in Europe

# PRO-TECTOR OF OILSEED RAPE FIELDS

Integral® Pro successfully protects the plant through **three mechanisms**:



# 1

The biofilm that develops from it **reduces the possibility** of settlement of other pathogens.



# 2

The *Bacillus amyloliquefaciens* MBI 600 **produces components** that stop the development of fungal spores.



# 3

In addition, **plant defense mechanisms** are activated, which strengthens the natural defenses of the plant and minimizes the infestation of the flea beetle.

## HOW DOES IT WORK?

# INTEGRAL® PRO WITH MULTIPLE MODES OF ACTION

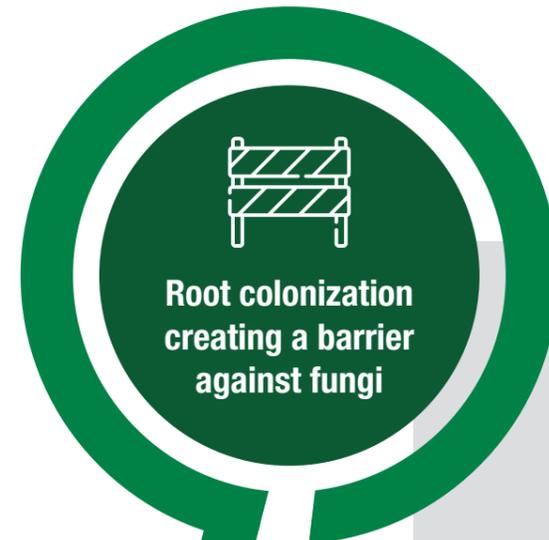
TRUE FUNGICIDAL ACTION THAT NOT ONLY PROTECTS THE OILSEED RAPE, BUT ALSO STIMULATES ITS DEVELOPMENT.

Integral® Pro employs three different mechanisms of action that provides **holistic protection**. This makes Integral® Pro not only a crop protection

product, but also a supplementary tool for integrated pest and disease management programs.

## ACTIVE STRENGTHENING OF PLANT DEFENSES

Integral® Pro works by activating **Systemic Acquired Resistance (SAR)** and **Induced Systemic Resistance (ISR)**. The activity of *Bacillus amyloliquefaciens*, MBI 600, as an elicitor of SAR or ISR pathways in seed treatment, measured by the expression of both the SAR and ISR pathways marker genes by qPCR.

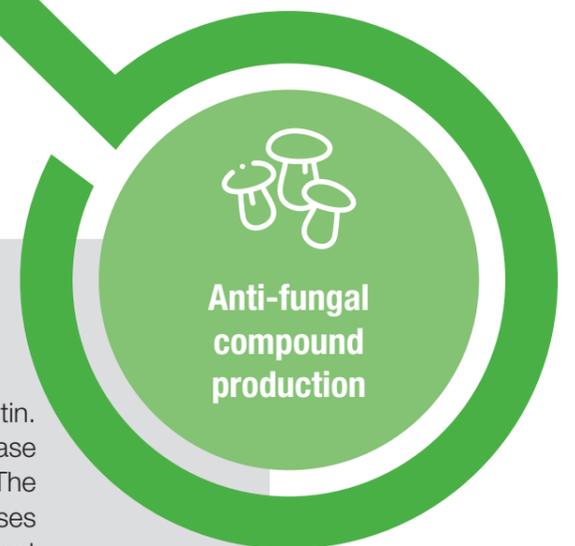


## A BIOFILM THAT FILTERS FOR BENEFICIAL PROPERTIES

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 results in physical exclusion to other non-beneficial bacteria and fungi.

## ZONE OF EXCLUSION FOR A STRONG PROTECTION

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.



MULTIPLE MODES OF ACTION

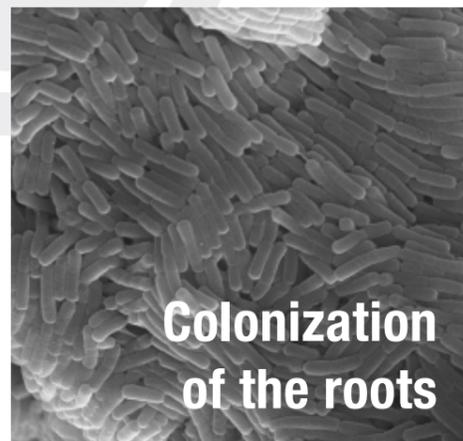


## ROOT COLONIZATION CREATING A BARRIER AGAINST FUNGI

Successful and continuous colonization of the roots provides the plant with a long-term protective film against various attacks.

- The constantly growing colonies of Integral® Pro are thereby able to move along a growing root, so that it is provided with protection from all possible sides.
- While the actual roots continue to grow, they are steadily colonized by Integral® Pro. This continuous colonization creates an effective and dense biofilm, which provides intensive protection.

**Very effective  
against a multitude  
of pathogen species**



**Colonization  
of the roots**

MULTIPLE MODES OF ACTION

## ANTI-FUNGAL COMPOUND PRODUCTION



Integral® Pro sustainably promotes the production of compounds that break down the membranes of fungal cells, thereby protecting the plants.

**Integral® Pro acts  
as a fungicide,  
protecting the plant  
from various infections**

- Integral® Pro produces *iturin* and *surfactin*, which act as a compound against the growth of diseases and the germination of disease spores and can thus protect the plants.



**Barrier  
forming with  
Integral® Pro**



**Pathogen  
developing**

MULTIPLE MODES OF ACTION



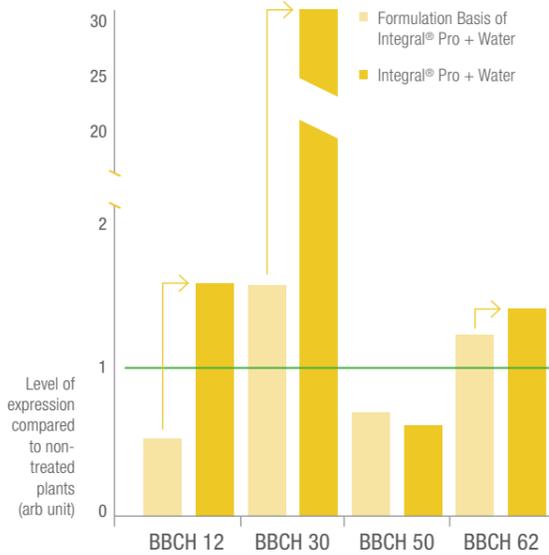
# PLANT DEFENSE STIMULATION

To strengthen plant defenses, systemically acquired resistance must be activated and induced.

- Integral Pro activates genes involved in plant defense pathways, that are **ISR** and **SAR**, enabling effective protection.
- This activation method has already been confirmed by genome sequencing.

## Induced Systemic Resistance (ISR)

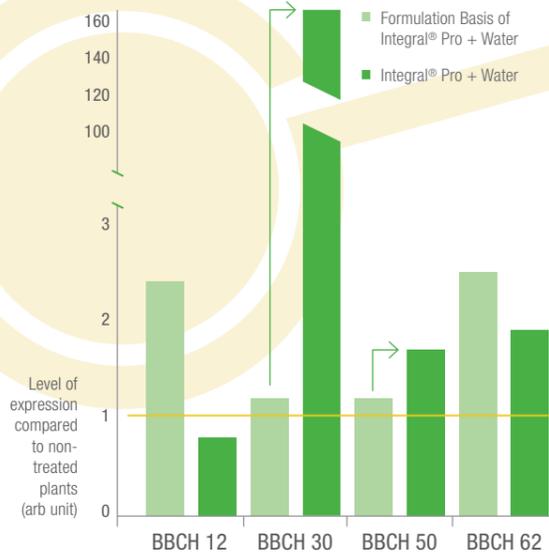
Geometric mean of the five experiments (JA pathway marker)



Activation of the IRS pathway according to seed treatments and stage of development of the plant. The histogram corresponds to the geometric mean of 5 experiments. The green line marks the level of activation for the marker gene of JA pathway (ISR) compared to negative control conditions (non-treated). Yellow arrows showing an activation of this pathway by Integral® Pro compared to the formulation basis of Integral® Pro.

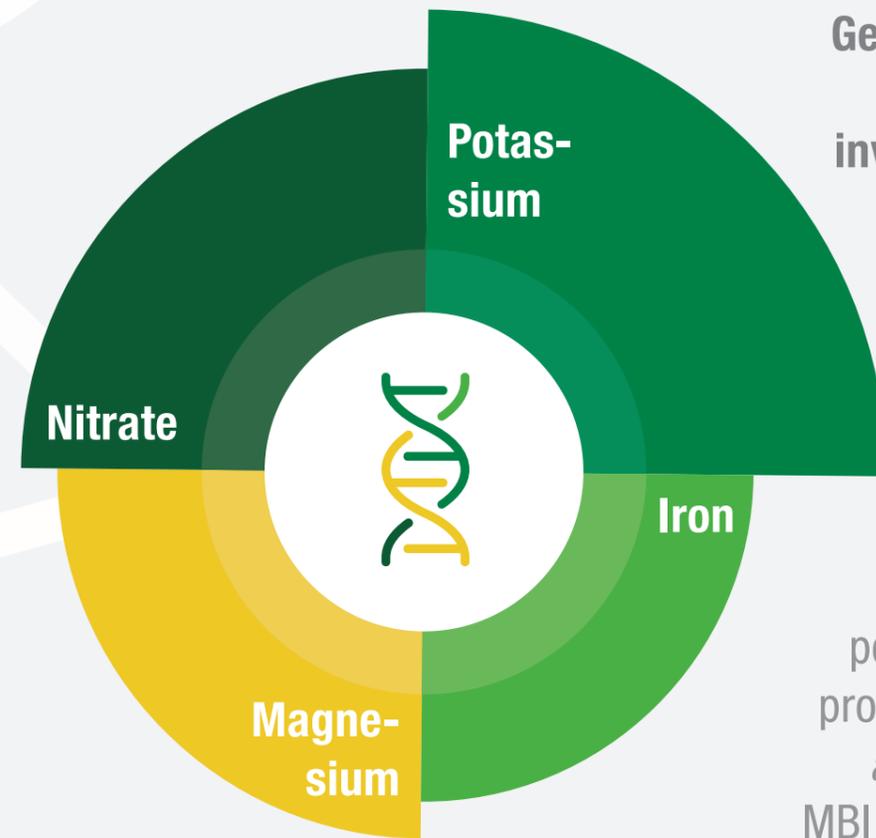
## Systemic Acquired Resistance (SAR)

Geometric mean of the five experiments (SA pathway marker)



Activation of the SAR pathway according to seed treatments and stage of development of the plant. The histogram corresponds to the geometric mean of 5 experiments. The yellow line marks the level of activation for the marker gene of SA pathway (SAR) compared to negative control conditions (non-treated). Green arrows showing an activation of this pathway by Integral® Pro compared to the formulation basis of Integral® Pro.

# INTEGRAL® PRO HAS A PROVEN EFFECT ON PLANT STIMULATION AND PROMOTES NUTRIENT UPTAKE THROUGH GENE INDUCTION.



Genome sequencing identified genes involved in different pathways

Whole genome sequencing and root colonization studies revealed novel insights in the biocontrol potential and growth promotion by *Bacillus amyloliquefaciens* MBI 600 on cucumbers

### Nitrate

Transport and reduction

Creation of plant proteins and aminoacids used in vegetative development.

### Potassium

Cell wall reinforcement

Disease resistance

### Iron

Uptake increase

Part of enzymes, role in respiration, synthesis of chlorophyll and photosynthesis.

### Magnesium

Transport and reduction

Protein synthesis and chlorophyll production

# FOR A SUSTAINABLE FUTURE

## WE SET TARGETS



**Climate Smart Farming:** -30% CO<sub>2</sub> per ton of crop produced by 2030.



**Sustainable Solutions:** 7% annual increase in our share of solutions with substantial sustainability contribution.



**Digital Farming:** 400+ million hectares supported with digital technologies by 2030.



**Smart Stewardship:** Safe use of our products with the right stewardship.

### Our sustainability commitments as a leader in agriculture

BASF wants to be part of a sustainable future and not only show its interest in the environment but also put it into practice.

At BASF we are committed to helping farmers to tackle the most pressing climate challenges with technologies that support them in increasing yield, enhancing robustness in farm operations and decreasing environmental impact.

A holistic approach is needed to find that balance so that we can promote biodiversity and mitigate the impacts of climate change, while at the same time helping our customers produce enough safe and healthy food in a more sustainable way.

The Integral® Pro profile, its mode of actions and benefits, clearly participate in our journey towards sustainable farming. Integral® Pro provides the oilseed rape grower with a new and effective tool to manage their crop while respecting our principal targets.

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