More efficient and sustainable pesticides

DEMOGRAPHIC GROWTH

73 million people
(in 2021: 67 million)

In **2050**

there will be **more and more** mouths to feed...

10 billion people
(in 2021: 7 billion)

How to **increase crop production**?

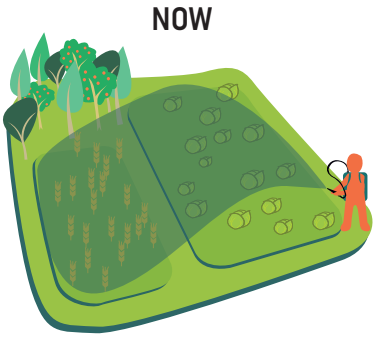
How to make crop production **more efficient** and **more sustainable**?

THE SPECIFICITY OF NANOPESTICIDES
compared to regular pesticides

✓ targeted delivery : **controlled release by the plant**, where it is needed

POTENTIAL BENEFITS OF NANOPESTICIDES

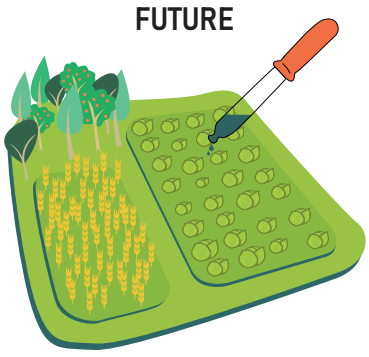
NOW



From pesticides

to nanopesticides

FUTURE



More sustainable agriculture:

- ✓ **Reducing** the quantity of pesticides
- ✓ **Reducing adverse effects** on non targeted organisms
- ✓ **Increasing** agricultural **production**

OBJECTIVE

Developing **more efficient nanopesticides** with **targeted release** to provide **more sustainable phytosanitary products**.

SOME RESULTS OF THE PROJECT

Nanopesticides have been **grafted on an organic matrix made of biocompatible and biodegradable biopolymers**, using green synthesis methods.

The efficiency of these new nanopesticides has been tested on **two major pathogen fungi** (*Septoria nodorum* and *Fusarium graminearum*) of wheat.

Antifungal activity

Regular pesticide

Nano form of the pesticide

Nano form of the pesticide is twice as **efficient** as the regular one.

Information

During its **growth**, **the plant acidifies the soil** around the root tip and **allowing to take up nutrients**.

This root tip is a hot-spot for interactions with the environment and an **entry point for plant-pathogens.**

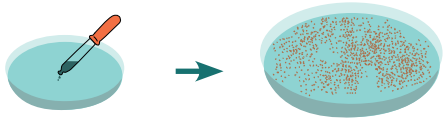
A released control by the pH

The nanopesticides were designed **to release the biocidal agent only around the root**, where the pH is a acidic, **to inhibit root infection** by the pathogens.

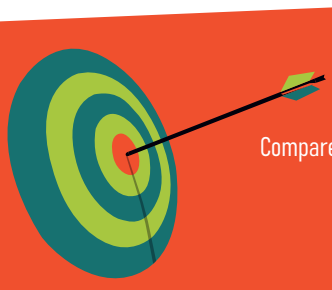
To test this pH-controlled release, the nanopesticides were applied to fungi grown in acidic or basic conditions:

Effect of nanopesticides on pathogen fungi at low pH

Effect of nanopesticides on pathogen fungi at high pH



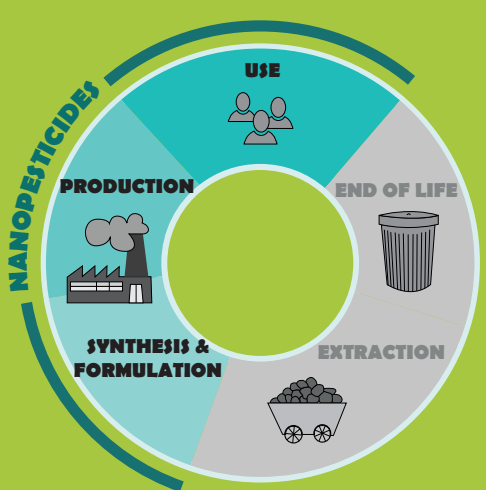
The growth of the fungi is inhibited only at low pH, showing that **the pH-controlled release works**. This avoids a wide release of the nanopesticides into the soil.



Compared to regular pesticides, **nanopesticides have advantages**:

- more efficient → **reduction of the quantity needed**
- more targeted release → **limit the impacts on non targeted organisms**

LIFE CYCLE STAGES STUDIED



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Serenade
Safe(r) Ecodesign Research and Education applied to nAnomaterial DEvelopment.

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