



# SUSTAINABLE AGRICULTURE

Yeast is a powerful ally for a more sustainable agriculture, by reducing dependence on chemical products and providing an alternative to the use of antibiotics in livestock.



## ROLE OF YEAST

### Biostimulation and Bionutrition

New ranges of products based on yeasts and other microorganisms have been developed to improve plant growth conditions and increase agronomic performance, with three types of actions:

- Stimulation of plants' biological resistance to abiotic stresses (drought, heat...).
- Improving the bioavailability of soil nutrients and thus their uptake by plants.
- Improvement of the rhizosphere or "plant microbiota". This part of the soil close to plant roots is very rich in microorganisms and biological substances and is in continuous interaction with the plants. New yeast-based products enhance soil fertility. They can be applied via irrigation water in field crops and high value crops (vines, market gardening, horticulture, etc.) in both conventional and organic farming.

### Biofungicides (Biocontrol):

Yeasts protect plant health by serving as excellent natural bio-fungicides, managing the balance of pest populations rather than eradicating them. Thanks to their ability to grow quickly in a wide range of environments, they act preventively by spatial and nutrient competition against the occurrence of fungal diseases such as botrytis, powdery mildew and downy mildew. These natural agents are safe for humans and the

environment. Some specific yeast derivatives are elicitors as they stimulate plant defence and prime the plant against fungal disease. Some yeast components can be recognised by special receptors located on plant cell membranes. These receptors trigger intracellular defence pathways. This response results in enhanced synthesis of metabolites which reduce damage and increase resistance to pests and diseases.

### Probiotic for livestock:

Antibiotic resistance, linked to the excessive use of these drugs in livestock, is a serious threat to animal and human health. Yeasts can be used as a probiotic to boost animals' immune systems and gut health, thereby enabling a significant reduction in the use of antibiotics. They act on the digestibility of feed and the reduction of animal stress while optimising growth potential. They are used as feed additives to protect the microbial communities in the digestive tracts of monogastric and ruminant animals to regulate ruminal pH and reduce the risk of acidosis.

### Organic fertilizer:

At the end of the industrial yeast production process, molasses and sugar syrup substrates used to grow yeast are rich in valuable nutrients, that are valorised by yeast producers in the form of feed for livestock or potassium-rich biofertilizers (vinasses).



## A SHORT HISTORY

According to Scopus publications\*, the use of yeast in agriculture originated in 1880.

However, for decades, the yeast flora and their diversity have been highly neglected for research purposes regarding agricultural use.

A strong development of scientific research on the uses of yeast for sustainable agriculture emerged in the 2000s, and its business applications have increasingly accelerated since the 2010s.



## KEY DATA IN AGRICULTURE

### Use of yeast in agriculture:

According to the Scopus study\*, the use of yeast in agriculture and biological science has exponentially increased since the year 2000, as recorded by increasing interest in research papers on the use of yeast for more sustainable agriculture (over 3000 papers in 2018).

### Biocontrol†:

- The biocontrol market grew by 40% in value between 2015 and 2019 when, at the same time, conventional products decreased by 19%.
- The share of biocontrol in the crop protection market increased from 3.3 to 5.6% between 2015 and 2019.
- Yeast as a biocontrol agent is used in viticulture, arboriculture, and marginally in vegetable and field crops.

### Biostimulant†:

- The biostimulants market grew by +25% in value between 2015 and 2019 when, at the same time, fertilization products decreased by 6%.
- Yeast as a biostimulant is used in field crops, viticulture, arboriculture and vegetable crops.



## SPECIES OF YEAST USED

- A wide range of yeast strains are used for more sustainable agricultural purposes: from *Ascomycetes* (e.g., *Saccharomyces*, *Candida*) to *Basidiomycetes* (e.g., *Filobasidiella*, *Rhodotorula*).
- In the animal feed industry, *Saccharomyces cerevisiae* is the most commonly used yeast species.
- There are 23 genera of yeasts reported to have plant growth-promoting capabilities and the dominant ones are *Candida spp.*, *Rhodotorula spp.*, *Cryptococcus spp.*, and *Saccharomyces sp.*



## PROSPECTS AND INNOVATIONS

### Yeast Microbial Consortia

The application of microbial consortia is a new approach in synthetic biology. Synthetic yeast consortia, simple or complex synthetic mixed cultures, have been used to produce various metabolites. Cooperation between the members of a consortium and cross-feeding can be applied to create stable microbial communication. These consortia can consume a variety of substrates, perform more complex functions, produce metabolites in high titer, rate, and yield (TRY), and show higher stability during industrial fermentations. Given the novelty of this approach, few yeasts are used to build these consortia, including *Saccharomyces cerevisiae*, *Pichia pastoris*, and *Yarrowia lipolytica*.

Yeast consortium has important plant growth promotion, biocontrol and pesticide remediation properties. Therefore, these consortia can be used as potential inoculum for boosting agricultural productivity and detoxification of pesticides from soils. These are cost-effective, environment-friendly and socially acceptable, as they reduce chemical and pesticide application.

\* Data from a Kynetec study, a consultancy firm specialising in data, analytics and insights from the agricultural sector.