KOPPERT

BIOLOGICAL SYSTEMS

CONTENT

Our challenges

Introducing Koppert

Trends

Panoramix

KOPPERT BIOLOGICAL SYSTEMS

Koppert Biological Systems
Partners with Nature

Koppert Biological Systems contributes to better health of people and the planet.

In partnership with nature, we make agriculture healthier, safer and more productive.

We provide an integrated system of specialist knowledge and natural, safe solutions that improves crop health, resilience and production.

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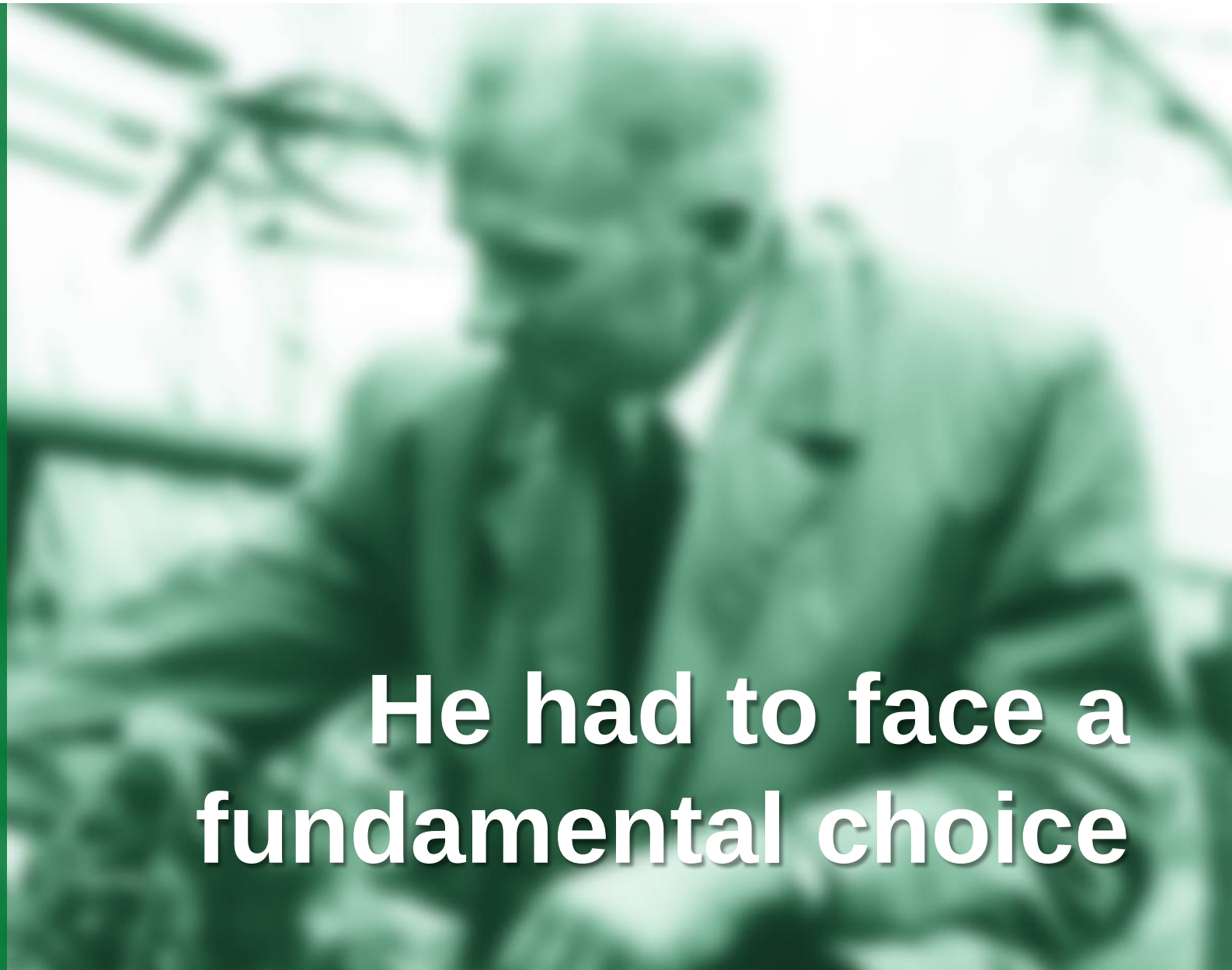
1967

- Jan Koppert
- Chemical control
- Decreasing efficacy
- Need for alternatives
- The first natural enemy to combat spider mite infestation
- Positive results and effects



He had to face a fundamental choice

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KOPPERT BIOLOGICAL SYSTEMS

- Founded in 1967
- 1600 employees worldwide
- 30 Subsidiaries
- 120 countries successfully applied Koppert's system

Koppert started with beneficial insects

Nowadays a more holistic or total approach is used in both horticulture and agriculture

SUSTAINABILITY-FOOD-HEALTH

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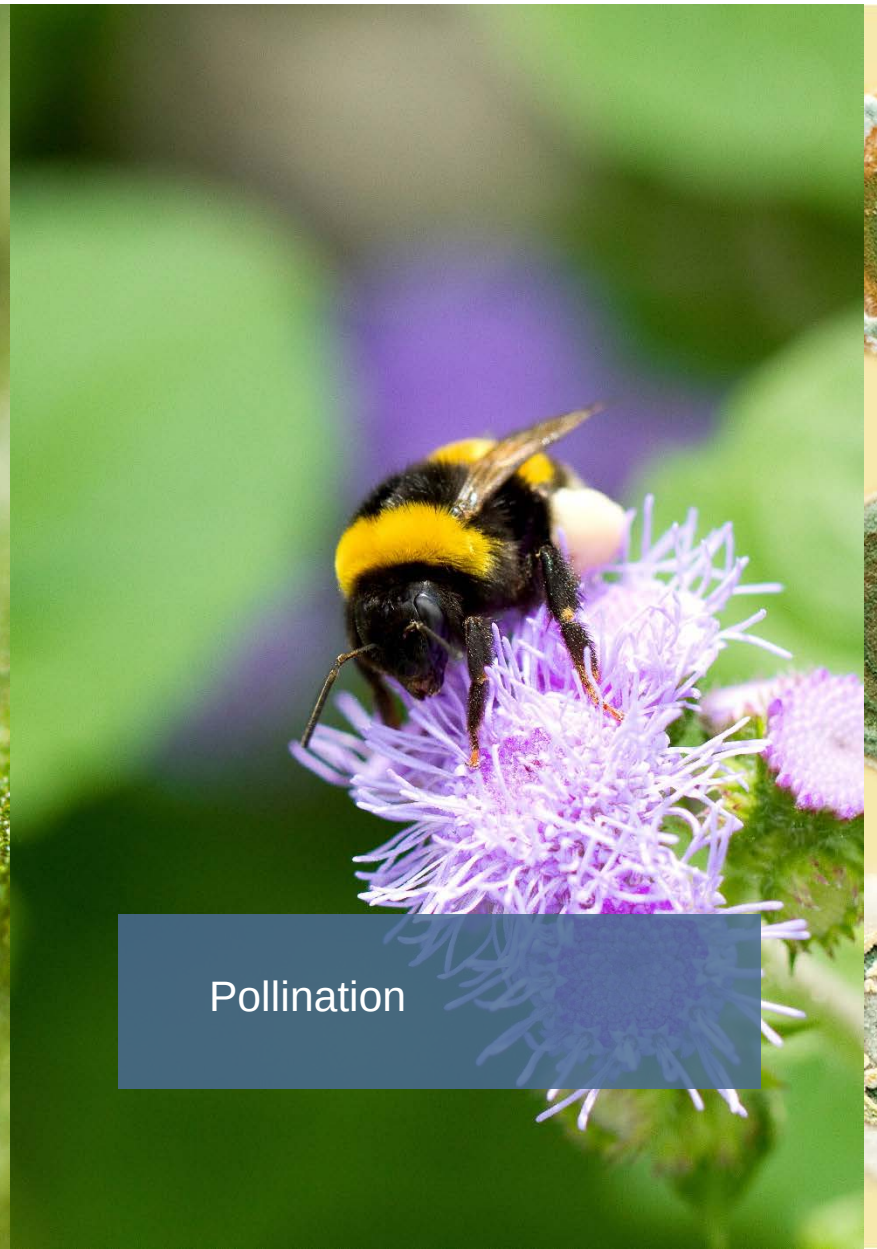
Macrobials



Pollination

Microbials

Key drivers for implementing Biological solutions

- Pesticide resistance
- Residu management (license to supply in market)
- Productivity and Quality
  (Influence of pesticides and fertilizers)

RESEARCH & DEVELOPMENT

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R&D HAS BUILT UP EXTENSIVE KNOW-HOW REGARDING:

- Pests and predators
- Diseases and beneficial micro-organisms
- Biostimulants
- Pheromones
- Pollination
- Application techniques & monitoring
- Optimal soil condition
- Plant resilience
- This know-how is the basis for enormous production efficiency and quality improvement in many crops worldwide

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THE WORLD IS CHANGING

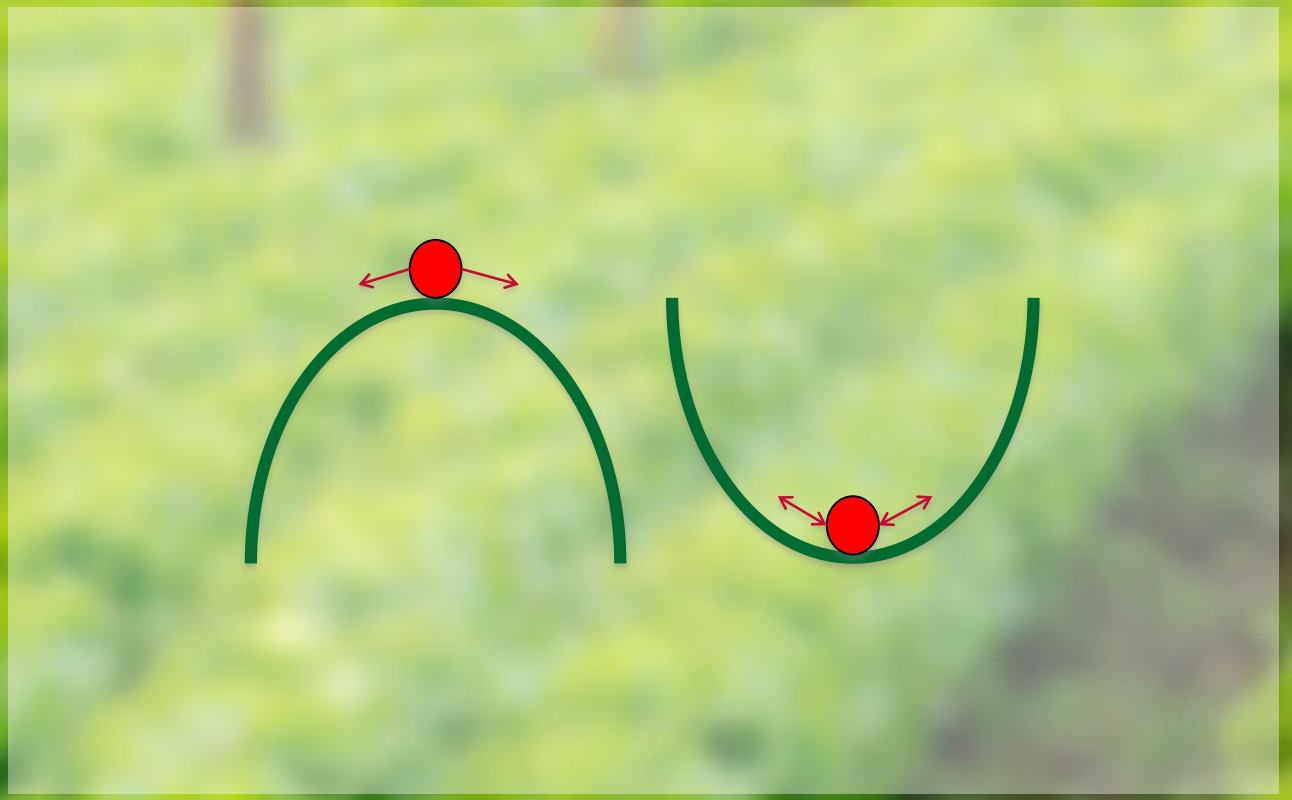
- Keeping biodiversity
- Reducing greenhouse gases
- Soil fertility/ water quality
- Sustainable intensification
- Food safety/security
- 10 billion 2050/70% city

TRENDS

- The Market demands residue-poor or even residue-free products
- Retailers and supermarket impose extra-legal requirements on farmers
- More attention for work safety
- Society and Legislator want less impact on the environment and public health
- Sustainable production: more production with less input and less impact

KOPPERT “BIOLOGICAL SYSTEMS”

- From reactive to proactive
- Resilient production systems
  - From risky balancing …
  - … to self-balancing systems
- Biological control (army)
- Slowing down pest and disease development
- Systems thinking at all system levels (prevention)
  - Resilient plant (seed to crop)
  - Resilient soil/substrate



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Panoramix – the biological seed dressing

Constanze Holzfuß

Koppert Biological systems

PANORAMIX:

Microbial seed dressing

WHAT DOES PANORAMIX CONTAIN?

Others

- Vitamins C & E
- Fulvic acid
- Algae extracts
- Vegetable oil

Trichoderma sp.

- Colonizes rhizosphere: root elongation
- Forms barrier against pathogenic fungi
- Solubilizes Fe, Mn, P

→ **Boosts crop growth**

Endomycorrhiza

- Live in symbiosis with plant roots, forming a network of mycelia that colonize rhizosphere → Increases plant's resistance to drought
- Increase absorption of water and nutrients by the roots

→ **Boosts crop growth**

Bacillus sp. I

- Creates a film around the roots
- Prevents infections

→ **Boosts crop growth**

Bacillus sp. II

- Makes less or insoluble P in the soil available for the plant through solubilization and mineralization

→ **Boosts crop growth**

PANORAMIX INGREDIENTS: MYCORRHIZA

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PARTNERS WITH NATURE 50 YEARS

DEFINITION

- Mycorrhiza is a widespread group of symbioses between plant roots and fungi.
- It existed already, when the plants conquered the main land about 410 million years ago.
- Today about 80% of all plant species are involved some kind of mycorrhizal interaction.

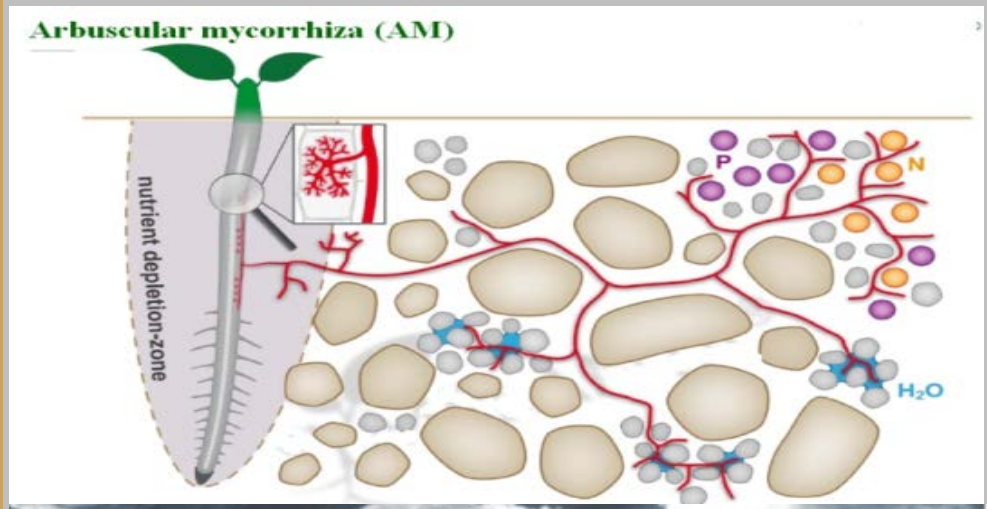
MYCORRHIZA: ACCESS TO NUTRIENTS AND WATER

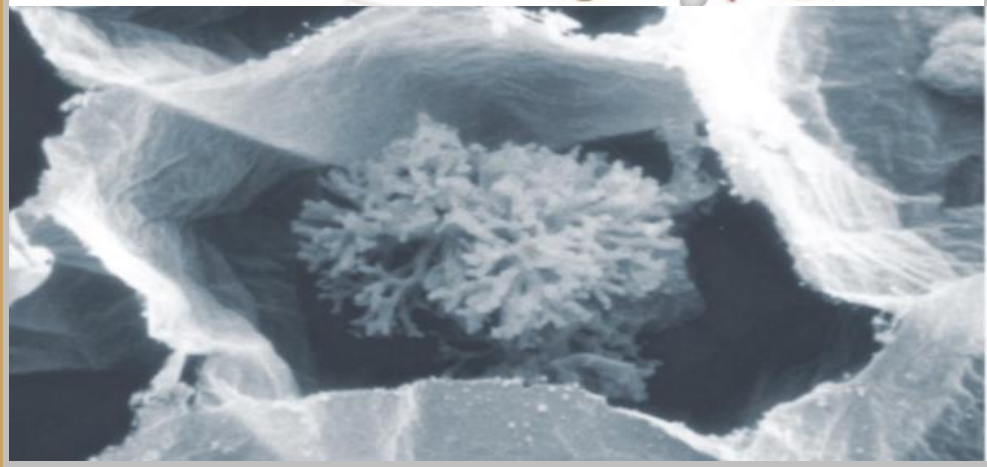
SYMBIOTIC ASSOCIATION BETWEEN PLANT ROOTS – FUNGUS:

- Grows IN the root cells and connects roots to nutrients (far) away from the roots
- Easier intake of f.e. Nitrogen & Phosphor
- Mycorrhiza increases drought resistance through absorbing water in wet period and retaining it in dry periods.

RESULTS

- Optimizes use of water & fertilizers
- More resistance to abiotic stress
- Improves soil quality





MYCORRHIZA: CARBOHYDRATE AND ENERGY METABOLISM

- The mycorrhizal mutualistic association provides the fungus with relatively constant and direct access to carbohydrates, such as glucose and sucrose.
- The carbohydrates are translocated from their source (usually leaves) to root tissue and on to the plant's fungal partners.
- In return, the plant gains the benefits of the mycelium's higher absorptive capacity for water and mineral nutrients.
- The effect is thus to improve the plant's mineral absorption capabilities.

DISEASE, DROUGHT AND SALINITY RESISTANCE AND ITS CORRELATION TO MYCORRHIZAE

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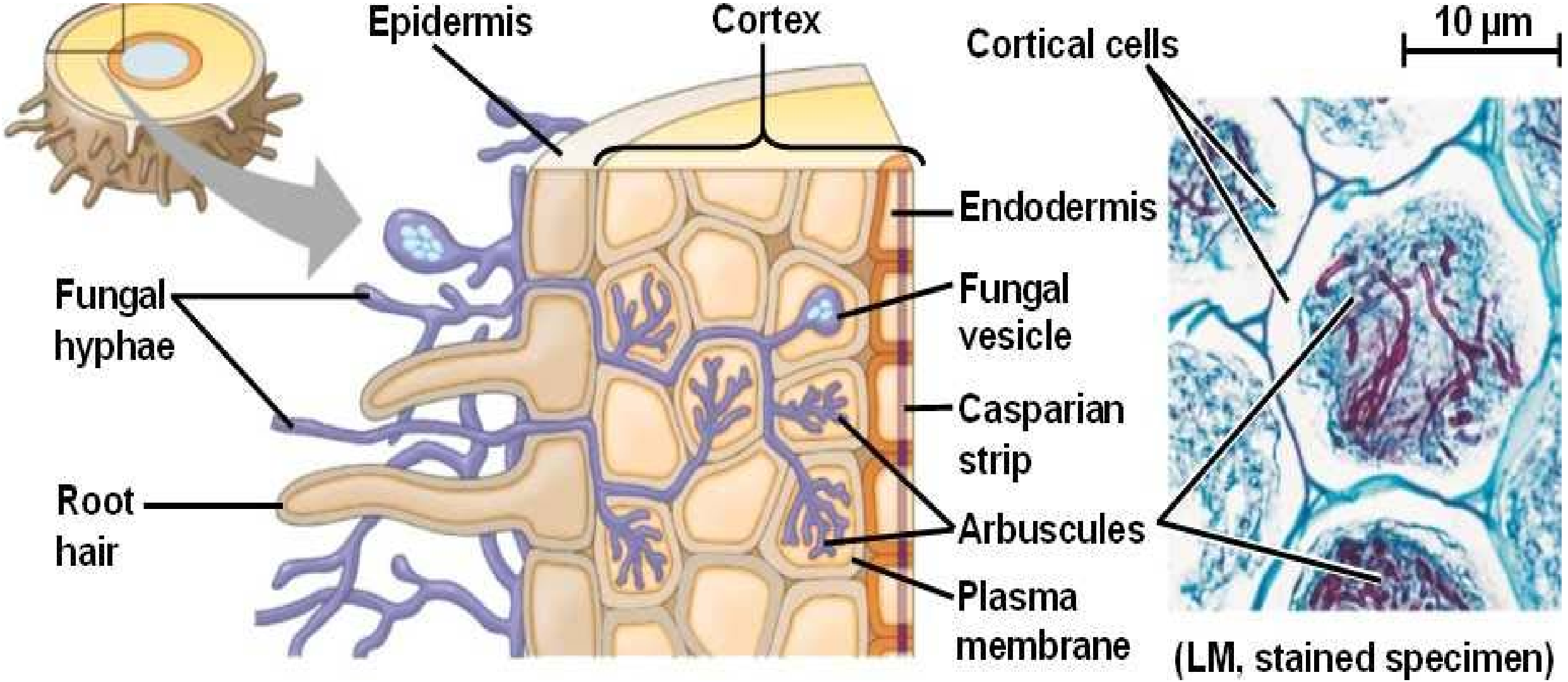
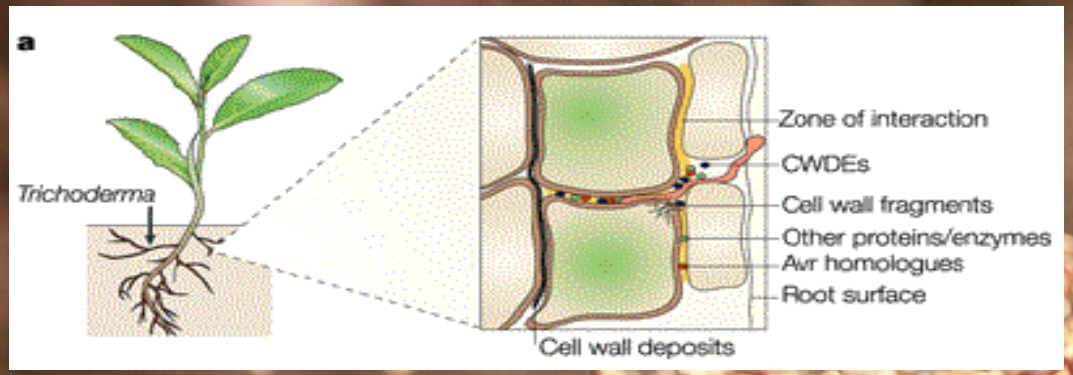
PARTNERS WITH NATURE 50 YEARS

- Mycorrhizal plants are often more resistant to diseases, such as those caused by microbial soil-borne pathogens.
- Mycorrhiza correlate with soil biological fertility variables such as soil fungi and soil bacteria, including soil disease.
- It is significantly correlated with soil physical variable and are also more resistant to the effects of drought.
- The significance of arbuscular mycorrhizal fungi includes reduction of salt stress and its beneficial effects on plant growth and productivity.

ENDO MYCORRHIZA



PANORAMIX INGREDIENTS: TRICHODERMA SP – PROTECTION



MODE OF ACTION

- Makes nutrients better available (Manganese, Phosphor, Iron, etc.)
- Protects the roots from harmful fungi:
  - Takes away nutrients from harmful fungi
  - Covers roots, not leaving room for harmful fungi
  - Protects roots from diseases

RESULTS

- Stronger crop > less problems with diseases and increased yield

PANORAMIX INGREDIENTS: BACILLUS AMYLOLIQUIFASCIENS BOOST PLANT IMMUNITY

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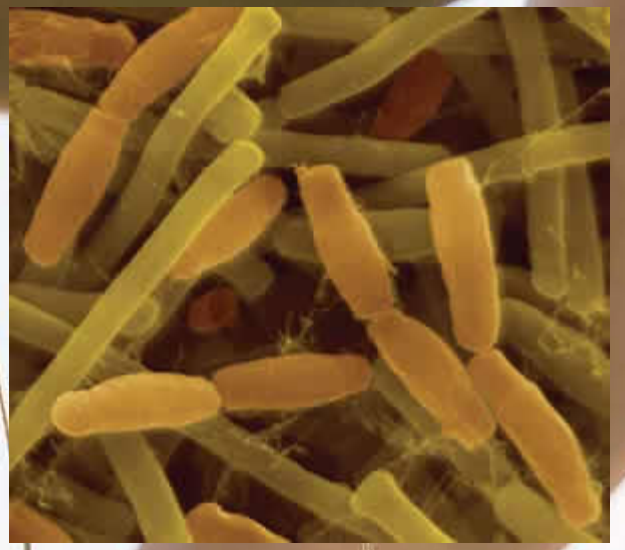
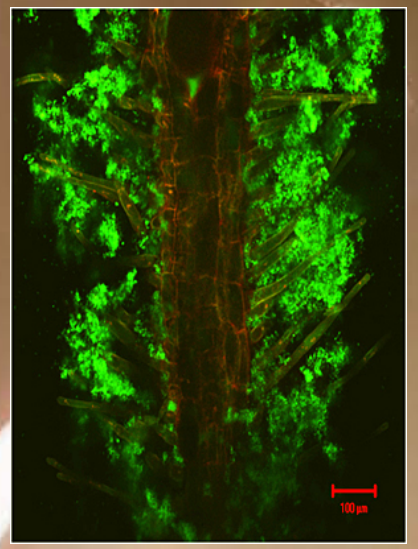
PARTNERS WITH NATURE 50 YEARS

MODE OF ACTION

- Protective biofilm around plant roots
- Disease control: malic acid to fight disease
- Plant growth promotor, helps the crop with abiotic stress (such as drought stress)
- Quick start root colonization





PANORAMIX INGREDIENTS: BACILLUS MEGATERIUM – POTASSIUM INTAKE

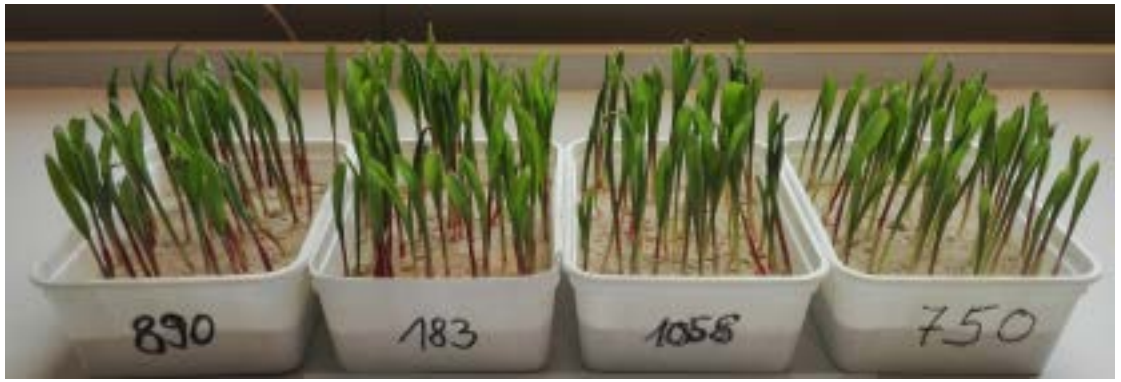
MODES OF ACTION

- Produces organic acids such as citric and gluconic acids and enzymes
  - Helps solubilize fixed potassium into a form which is available for the crop

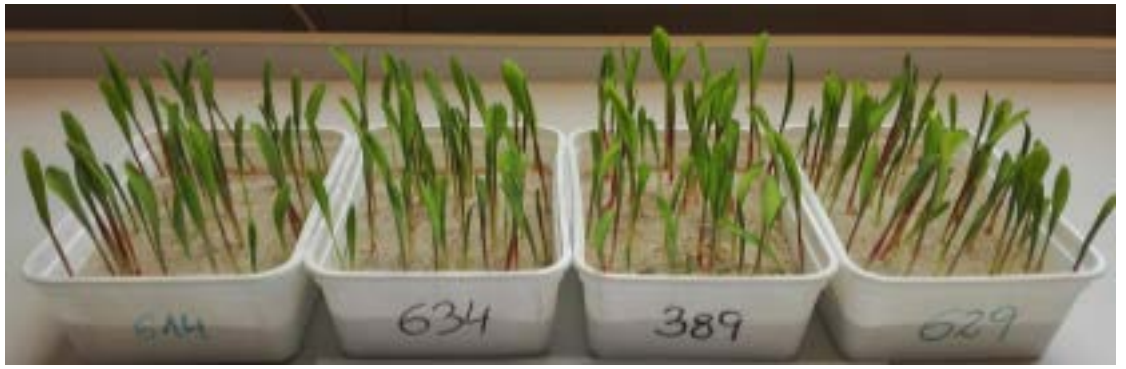
RESULTS

- Optimize the use of Potassium
  - Less needed

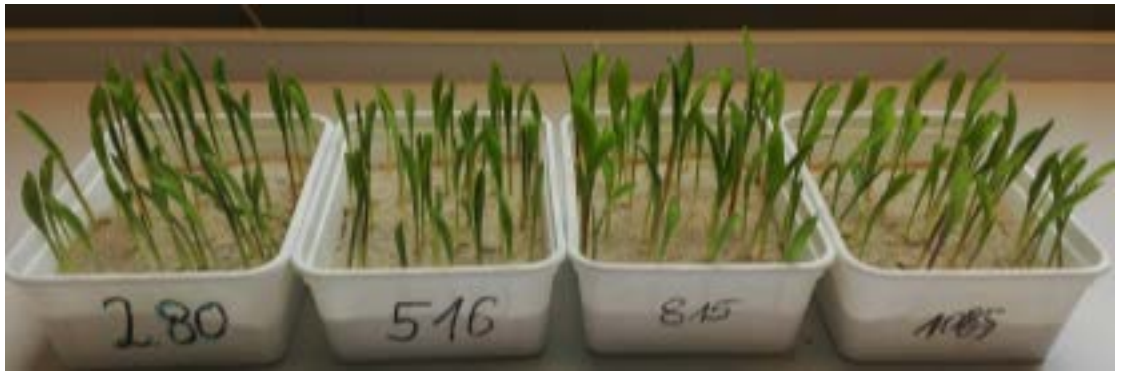
PANORAMIX FROM THE LAB…



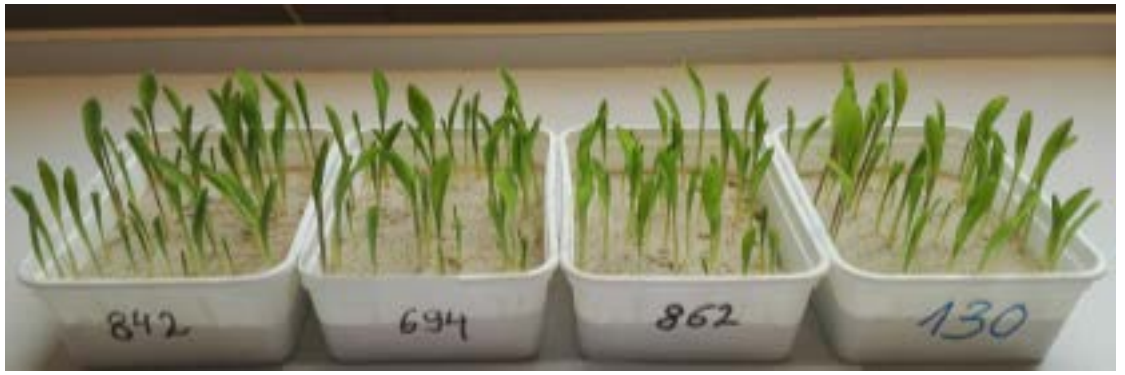
Conventional seeds with Maxim



Organic seeds treated with Panoramix



Conventional seeds untreated



Organic untreated

... TO THE FIELD

Panoramix for a sustainable secure production

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PARTNERS WITH NATURE 50 YEARS

THANKS FOR YOUR ATTENTION!

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