



## Biostimulants from ekolive

In addition to biological soil remediation (cleaning of pollution – including pesticides) with bacteria, **ekolive** produces highly effective biostimulants that are listed on the input list for organic production (FiBL Netherlands). These complex and therefore unique biostimulants consist of plant growth-promoting bacteria, various effective organic acids and dissolved minerals – and are currently produced at five locations in Europe using an EU-certified bioleaching process.

They are basically environmentally friendly, ecological, sustainable – and serve in general

- increasing the efficiency and yield of classic fertilizers by improving nutrient uptake and nutrient utilization by the plants;
- the improvement of all quality characteristics of the plants;
- faster germination, development and acceleration of growth – above all by promoting root growth and thus enlarging the root surface;
- increasing the germination rate and the yield (by 30 – 400 percent), thus securing the yield;
- increasing the immunity of plants against pathogens;
- the increase in the nutrient and sugar content of the plants (by up to 150 percent);
- increasing the plants' resistance to abiotic stresses – such as drought, heat and cold.

**ekolive** currently has 2 different products on the market:

### **ekofertile® plant**

A liquid biostimulant made on the basis of bioleaching of sand with natural bacteria, with a pH of 4 - 4.5.

**ekofertile® plant** contains probiotic bacteria (mainly *lactobacillus*, *bifidobacterium*, *lactococcus*), a variety of valuable organic acids produced by the bacteria (*lactic acid*, *butyric acid*, *acetic acid*, *amino acids*, *methanol* and *ethanol*) and dissolved *Fe-Mn oxides* and *-hydroxides*, *mica* and *feldspar*.

The special effects of **ekofertile® plant** include increasing the germination rate and yield, faster development and acceleration of plant growth, vitalizing and revitalizing plants, increasing plant health and immunity to pathogens, increasing nutrient and of sugar content, as well as an increase in resistance to abiotic stress. **ekofertile® plant** increases the availability of macro and micronutrients in the soil, which compensates for deficits in fertilization and thus in yield and nutrient content of the plants – even in the transition phase from conventional to organic agriculture. The application of **ekofertile™ plant** also leads to a restoration of the microbiome in the soil – and thus to a strengthening of the immunity of the plants – as well as to a higher water storage capacity of the soil (by up to 25 percent). The bacteria contained colonize the plants themselves and the roots – and thus effectively prevent infestation with other microorganisms (bacteria and fungi).

The use of **ekofertile® plant** is generally recommended during the growth phase and just before harvest for a short-term increase in the nutrient and sugar content of the plants. In addition, **ekofertile® plant** helps effectively with the pre-germination (especially of potatoes and other set crops) as well as the (re)vitalization of plants and trees.

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Application: During the growth phase, apply at least three times by spraying or watering the plants or the soil with a 1 to a maximum of 3 percent solution (1–3 litres of **ekofertile® plant** per 100 litres of water). Higher concentrations (up to 25 percent) can also be used cautiously for pre-germination and (re)vitalization. The general rule is: never "over-fertilize" with too high concentrations, especially with young plants, the maximum possible concentration should be determined carefully. Repeated use at lower concentrations is better than high concentrations. A joint application of **ekofertile® plant** with herbicides or pesticides is possible in principle (not with copper), but requires a trial in individual cases. The bacteria it contains are basically very resistant – and even if the bacteria are impaired, the other stimulating effects of **ekofertile® plant** are retained.

The use of **ekofertile® plant** is generally suitable for all field crops and horticultural plants, especially root vegetables, strawberries and melons, as well as for all trees and fruit trees and flowers. It can also be used in greenhouse irrigation systems or in hydroponic systems.

### **microfertile® plant**

A liquid biostimulant based on bioleaching of primarily silicified rock residues after coal mining with natural bacteria, with a pH of around 8.

**microfertile® plant** contains natural bacteria (mainly *thiobacillus*), green micro-algae (unicellular *Chlorella spp.*), a variety of valuable organic acids produced by the bacteria (e.g. *pyruvic* and *amino acids*) and 17 dissolved essential elements (micronutrients).

The special effects of **microfertile® plant** include increasing yield (mainly on oilseeds and protein formation), faster development and acceleration of plant growth, vitalizing and revitalizing plants, increasing plant health, as well as increasing resistance to abiotic stress – especially increasing resistance to cold (by the *thiobacillus* or the copper protein *rusticyanin* it contains – by up to an additional 7°C). Under ideal conditions (e.g. regular use in closed irrigation systems in greenhouses), **microfertile® plant** can completely replace conventional fertilizers. In addition, the increased resistance of the plants to cold ensures yields even at lower temperatures in the greenhouse and thus saves on heating costs.

In general, **microfertile® plant** can be used all year round as part of standard irrigation – especially in greenhouse irrigation systems or in hydroponic systems.

Application: Apply at least five times by spraying or watering the plants or the roots with a 5 to a maximum of 10 percent solution (5-10 litres of **microfertile® plant** to 100 litres of water). A much lower concentration (0.75-1%) can also be used effectively when watering plants or roots regularly (e.g. in greenhouses or hydroponic systems). "Over-fertilization" is not to be expected, but the general rule is: Regular use of lower concentrations is better than high concentrations. In principle, it is possible to apply **microfertile® plant** together with herbicides or pesticides (not with copper), but this requires a trial in individual cases. The bacteria it contains are basically very resistant – and even if the bacteria are impaired, the other stimulating effects of **microfertile® plant** are retained.

The use of **microfertile® plant** is generally suitable for all high-quality special crops including all oilseed and protein producing plants, fruit, vegetables and horticulture – especially for lawns, grasses, herbs, lettuce, tomatoes, hemp and all green leafy vegetables. Use in irrigation systems of greenhouses and hydroponic systems as well as in agricultural regions with a special need for organic acids is particularly recommended.



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### Biostimulants – between fertilizers and crop protection products

They are neither “direct” fertilizers nor pesticides – and yet biostimulants stand out in the spectrum of such aids precisely because they achieve the effects of both indirectly.

Biostimulants are classified as “fertilizer products” in the EU fertilizer regulation; According to this regulation, these are products whose function is to supply plants with nutrients. This classification of biostimulants is based on criteria that lead to an improvement in a) the efficiency of nutrient supply, b) the tolerance to abiotic stress, c) quality characteristics and d) the availability of nutrients in the rhizosphere (i.e. the area immediately supplied by a living Root affected space in the soil).

Plant protection products, on the other hand, are pest and weed control products, defined according to the EU Plant Protection Products Regulation as chemical or biological active ingredients and “mixtures” which are intended, among other things, to protect crops and their products from harmful organisms or to prevent their effects (e.g. insecticides, rodenticides).

The nutrient-supplying as well as the immunizing (not curative) effects of biostimulants result indirectly via a stimulation of the plant's own enzymes. The term “microbial inoculant” is also used appropriately in English. Biostimulants thus form a completely independent group of active ingredients that could hardly be better described than with the term “stimulation”: Biostimulants are defined by their functionality (direct and indirect) – and not by a dose-effect relationship.

Biostimulants are substances containing live microorganisms which, when applied to seeds, plant surfaces or soil, colonize the rhizosphere and/or the surface of the plant and promote growth such as immunity and promote resistance to biotic and abiotic stress factors through stimulation – and at the same time prevent colonization by other, pathogenic microorganisms in order to defend their symbiosis with their host plants.

The microorganisms in organic fertilizers restore the soil's natural nutrient cycle (natural weathering of minerals to supply plants with nutrients) and build up soil organic matter. Using organic fertilizers allows healthy crops to be grown while improving sustainability and soil health. Organic fertilizers are intended to reduce the use of synthetic fertilizers and pesticides, but cannot yet replace their use. Because they play multiple roles, a preferred scientific term for such beneficial bacteria is “*plant growth promoting rhizobacteria*” (PGPR).

### Composition

The two biostimulants **ekofertile® plant** and **microfertile® plant** have a complex composition – they primarily contain:

- ◆ Plant growth promoting probiotic bacteria;
- ◆ Valuable organic acids produced by the bacteria;
- ◆ Micronutrients released from the mineral base material by the organic acids (biotic weathering process) (with **microfertile® plant** up to 17 essential nutrients);
- ◆ Large amounts of valuable micro-algae (unicellular *Chlorella spp.* in **microfertile® plant**).



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### Effects of bacteria

The contained probiotic bacteria essentially have the following effects:

- ◆ Plant stimulation via the roots by triggering messenger substances (hormones) with various positive effects: stimulation of growth, germination rate, immunity, fertility, nutrient formation (protein, sugar, oil content), resistance to abiotic stress (shock, drought, salts, cold, heat...).
- ◆ Formation of organic acids, which in turn lead to natural biotic weathering of rocks and minerals, providing nutrients for plants.
- ◆ Indirect protective effect on the roots and leaves of the plants – on the one hand through the above-mentioned stimulation of immunity, on the other hand through the bacteria themselves, which do not allow their host plants to be colonized by other microorganisms.

### Multiple effect of ekofertile® and microfertile®

#### 1. Direct effect on the plants:

- ◆ By the bacteria: stimulation of the plants by triggering messenger substances (hormones) with various positive effects: stimulation of growth, germination rate, immunity, fertility, nutrient formation (protein, sugar, oil content), resistance to abiotic stress (shock, drought, salts, cold, heat...).
- ◆ Revitalization of the plants at any time.
- ◆ Through the micronutrients: Supply of the plants with up to 17 (**microfertile® plant**) essential nutrients.
- ◆ By the micro-algae (**microfertile® plant**): stimulation of growth and protein formation as well as tolerance to abiotic stress (shock, drought, salts, cold, heat...).

#### 2. Indirect effect on the plants:

- ◆ Through the organic acids: Rapid acceleration of the natural biotic weathering – thus increased availability of existing natural nutrients as well as applied artificial nutrients (fertilizer efficiency) for the plants.
- ◆ By the bacteria: prevention of colonization of the host plants with other microorganisms, both the roots and the leaves.
- ◆ By pre-treatment or pre-germination of the seeds: Supplementation of the core microbiome (which is given to the “offspring”) with the bacteria contained; these then become active in the germination phase and stimulate and protect the seedlings from stress and pathogens.

#### 3. Direct effect on soil / indirect effect on plants:

- ◆ Through bacteria, organic acids and micronutrients: revitalization of the soil biology / restoration of the microbiome (symbiotic environment of the plants) / (re)fertilization of the soil.
- ◆ Through promoted biotic weathering or through the oxidation processes triggered by the bacteria and organic acids: formation of humus / formation of micropores in the soil / thus up to 25% higher water storage capacity of the soil.
- ◆ By bacteria and organic acids: Degradation/breakdown of (organic) herbicides and pesticides remaining in the soil.