BioWerm Techno promotes phosphorus (P) absorption – the key to a strong root system and high yields

Phosphorus (P) is one of the three primary macronutrients for plants (alongside nitrogen and potassium) and plays a fundamental role in their growth, development, and yield efficiency. Although it is often present in large amounts in the soil, its availability to plants is limited. Therefore, it is crucial to support processes that increase its bioavailability—and this is where BioWerm Techno plays an important role.

Phosphorus is a component of compounds responsible for energy storage and transport (ATP). Thanks to this, it:
• enables key жизненные processes,
• supports photosynthesis and respiration,
• determines proper plant development.

Phosphorus:
• stimulates root development,
• increases the ability to absorb water and nutrients,
• is crucial in the early stages of growth.

Flowering and yield formation
Adequate phosphorus supply influences:
• flower and seed formation,
• plant maturation,
• crop quality (e.g., seeds and fruits).

Acceleration of maturation
Phosphorus:
• shortens the growing season,
• accelerates maturity,
• is especially important in cooler growing conditions.

Phosphorus deficiency causes:
• stunted growth,
• poor root system development,
• dark green or purplish leaf coloration,
• delayed flowering and maturation.

Excess phosphorus:
• occurs less frequently,
• may limit the uptake of other nutrients (e.g., zinc and iron),
• leads to nutrient imbalance.

Phosphorus in soil – why is it poorly available?
Phosphorus:
• moves very slowly in the soil,

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• is easily fixed (immobilized),
• its availability strongly depends on pH (most available at pH 6–7).

Forms of phosphorus available to plants
Plants absorb phosphorus only in soluble mineral forms:

1. **Phosphates – available forms**
   • $H_2PO_4^-$ (dihydrogen phosphate) – dominant in acidic soils,
   • HPO_4^{2-} (hydrogen phosphate) – present in neutral and alkaline soils.
   ☞ These are the only forms directly available to plants.
2. **Organic phosphorus**
   Occurs in:
   • plant residues,
   • manure,
   • humus.
   It is not directly available—it must be transformed by microorganisms (mineralization).
3. **Fixed (unavailable) phosphorus**
   A large portion of soil phosphorus is "locked":
   • in acidic soils – bound with iron (Fe) and aluminum (Al),
   • in alkaline soils – bound with calcium (Ca).
   These forms are practically unavailable to plants.

Processes increasing phosphorus availability
Phosphorus becomes available through:
• mineralization of organic matter,
• activity of soil microorganisms,
• root exudates (organic acids),
• maintaining appropriate soil pH.

The role of BioWerm Techno in increasing phosphorus (P) availability
BioWerm Techno supports natural biological processes in the soil that directly affect phosphorus availability. Its action is based on activating microorganisms and improving soil properties, which leads to:
• release of phosphorus from fixed forms,
• intensification of organic phosphorus mineralization,
• increased availability of phosphate ions ($H_2PO_4^-$ and HPO_4^{2-}),
• improved conditions for root system development,
• better utilization of phosphorus fertilizers.

As a result, plants can absorb phosphorus from the soil more efficiently, even with limited fertilization.

Summary
Plants absorb phosphorus mainly in the forms of:
• $H_2PO_4^-$
• HPO_4^{2-}

Organic and fixed phosphorus must be transformed to become available.

Effective phosphorus management is not only about supplying it but primarily about increasing its availability in the soil. BioWerm Techno supports these processes, contributing to better plant nutrition, a stronger root system, and higher, more stable yields.

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