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Faculty of Agriculture



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Plant-based preparations as multifunctional inputs in sustainable crop production systems

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Abstract

Since ancient times, plants have been used not only for food and human health but also as raw materials for construction, textiles, paper, and, more recently, bioplastics and bio-based industrial products. However, in modern agricultural systems, a substantial portion of plant biomass remains underutilized and is often treated as waste, including weeds, crop residues, and non-harvested plant parts from field crops, vegetables, orchards, vineyards, and medicinal and aromatic plants. The valorization of this biomass through the production of plant-based preparations represents a promising pathway toward more sustainable and circular agricultural practices. The use of plant-based preparations intensified with the development of biodynamic and organic farming systems in the early twentieth century. Today, such preparations are applied both in traditional on-farm production and as commercially formulated products registered for plant nutrition, plant protection, and soil improvement. These preparations contribute to enhanced soil biological activity and fertility, improved plant nutrition, and increased resilience of crops to biotic stress factors. In addition to preventive and curative effects against economically important pests and diseases, they are also used in soil and substrate disinfection and as microbial activity stimulators during composting processes, including in the production of compost teas. Plant-based preparations can be produced from fresh or dried plant material, preferably harvested from the beginning to full flowering stage when bioactive compounds are most abundant. Depending on the preparation method, several types are distinguished: infusions, decoctions, macerates, and fermented extracts, each differing in extraction procedure and intended agricultural application. Proper preparation techniques, including the use of non-reactive containers, are essential to preserve their biological efficacy. Plant-based preparations therefore represent low-cost, locally available, and environmentally friendly inputs that support agroecological crop production and reduce dependence on synthetic agrochemicals.

Key words: plant-based preparations, sustainable agriculture, biostimulants, agroecological crop production, environmentally friendly inputs

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