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Humic and fulvic acids as biostimulants for agricultural crops

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The ecological intensification of modern agriculture is a strategy for increasing the productivity and quality of crop production while preserving and enhancing soil fertility through (1) increased efficiency of mineral nutrition, (2) rational use of water resources, and (3) reduced need for chemical agents for integrated pest, disease, and weed management (Tittonell, 2014). In this context, there is a growing need for increasingly stress-tolerant and resource-efficient crop varieties, as well as for new agro-technical means possessing complex positive qualities, including high environmental safety.

Plant biostimulants, which are becoming widespread in Bulgarian agriculture, are innovative products that address these new challenges. The group of plant biostimulants is diverse and includes products with different raw materials and active substances. Among them are biostimulants containing humic and fulvic acids. These are products most often obtained from the utilization of organic waste generated by various human activities.

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The positive effects of humic substances on plant growth, mineral nutrition, and tolerance to stress factors are somewhat known, and their formulations were applied in practice in our country as early as the 1980s and 1990s. Methods for their production and some of their applications have been clarified and popularized by Stanchev (1977), Tanev (1987), and Sengalevich et al. (2007) from the Agricultural University – Plovdiv, as well as by other Bulgarian scientists. However, the mechanisms of action of humic acids are not fully revealed due to the complex nature of their impact, as well as their direct and indirect effects on plants and rhizospheric processes.

This material contains brief information on the chemical structure, production methods, and primarily the physiological and agronomic effects of humic and fulvic acids on plants.

Types, Structure, and Classification of Humic Substances

Humic substances are end products of the microbial decomposition and/or chemical degradation of dead animal and plant residues in soils. They are the most widespread organic molecules on Earth and are a major component of soil organic matter. Characterizing these substances is difficult and depends on many factors - origin, age, climate, biological characteristics, etc. Their molecular mass varies widely from 2.0 to 1300 kDa.

Sources and Methods for Obtaining Humic Substances

The main sources for obtaining humic and fulvic acids are leonardite, lignite, and vermicompost. Less commonly used sources are composted bark, straw, and organic fertilizers. The main methods by which they are obtained are physical, chemical, and biological.

Uptake of Humic Substances in Plants

Products containing humic and fulvic acids (HFA) are applied to the soil, foliage, and via seed treatment. When applied to the soil, they can exert both direct effects on plant roots and indirect positive effects in their rhizosphere.

Agronomic Effects of Humic Substances on Some Agricultural Crops

Most examples of successful application of these innovative products are in vegetable crops, as their use in this sector is currently the most widespread. Effects on yield, some quality characteristics, tolerance to stress factors, etc., have been indicated.

Research on the influence of humic substances is becoming increasingly relevant in our country as well. In production trials conducted at the Dobrudzha Agricultural Institute, General Toshevo, a positive effect of humic substances (the product Humustim) on the yields of lentils, peas, soybeans, vetch, and chickpeas was established (Mikhov, 2007). The effect of this product was confirmed in trials with other crops - zucchini (Haytova, 2009), beans (Tenova, 2012), and cucumbers (Arnaudov, 2015). The examples given do not exhaust

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the database proving the positive effects of HFA on plants. Alongside scientific research, in recent years, demonstration and production trials with various HFA-containing products have been increasing in our country, aiming to familiarize farmers with their positive qualities.

The team of the Department of Plant Physiology and Biochemistry at the Agricultural University in Plovdiv conducts systematic research ***on the physiological and agronomic effects of humic and fulvic acids in plants.*** These studies are conducted under controlled conditions with different crops and products, and with the help of modern scientific equipment, the obtained results are validated in production and demonstration trials.

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The full text can be read in issue 3/2017 of the special supplement "BIOSTIMULANTS FOR AGRICULTURAL CROPS", which is distributed together with the main body of the journal "Plant Protection"