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Editorial

Abiotic Stresses, Biostimulants and Plant Activity—Series II

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1. Introduction

Agricultural practices often mainly focus on maximizing productivity. For this reason, cultivation systems often have significant environmental and ecological impacts, as well as pose risks to the safety of the final products. The intensive use of soils, the consumption of freshwater, and the utilization of fertilizers and synthetic compounds, such as herbicides and pesticides, have severe repercussions throughout the global ecosystem [1]. All of these factors negatively impact the status of primary resources and contribute to greenhouse gas emissions and waste production [1]. In addition, agriculture follows a linear production model that can lead to an unsustainable use of natural resources [1].

We should also consider that agriculture is impacted by climate change, facing abiotic stresses like salinity, drought, and extreme temperatures [1]. These stressors significantly threaten plant growth, crop development, and overall agricultural output. These stresses are expected to increase in frequency and severity as climate change progresses. As a result, there is a serious risk of a significant decrease in crop yields, which is worrying, given the need to feed the growing global population.

We urgently need innovative strategies and smart solutions to address a major challenge for our farming systems: reducing the impact of climate change on agriculture while increasing its resilience and productivity.

In this context, the use of biostimulants is becoming increasingly attractive as they become more effective. These include various organic materials and microorganisms designed to improve plant performance in both normal and stressful conditions. Biostimulants are obtained from a range of natural sources, including protein hydrolysates, mainly of vegetal origin, plant and algal extracts, humic substances, some organic compounds, and bioactive inorganic elements. Biostimulants enhance plant growth, stress tolerance, and their water and nutrient use efficiency. In addition to these effects on crops, biostimulants can also induce benefits in soils, improving quality and fertility [2]. By optimizing crop growth conditions, even in challenging environments, and enabling plants to counteract the effects of abiotic and biotic stresses, biostimulants have the potential to enhance agricultural productivity.

In this context, the aim of this Special Issue of *Agriculture*, "Abiotic Stresses, Biostimulants, and Plant Activity—Series II", was to advance knowledge on the effect of biostimulants but also other materials and techniques (i.e., nanomaterials, priming, etc.) on promoting plants' growth, yield, and product quality, as well as in abiotic stress conditions. Therefore, this Special Issue considered scientific contributions regarding the stimulatory and protective effects of different biostimulants on crops, their mechanisms of action, and their qualitative, economic, or environmental benefits.

2. Special Issue Overview

In pursuing sustainable agriculture, researchers are exploring innovative strategies to mitigate the detrimental effects of abiotic stresses on agriculture and enhance crop productivity. Salt stress, one of the most impactful abiotic stressors, poses significant challenges

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to crop cultivation by impairing plant growth and compromising crop yield and quality. To provide increasingly valuable tools for containing such adversity, researchers have increasingly turned to biostimulants as a promising avenue for safeguarding crops against abiotic stresses and promoting sustainable agricultural practices. In line with the above, the study by Regni et al. [3] underscores the potential of plant biostimulants in mitigating salt stress effects on crop plants. Their investigation focused on assessing the effects of an aqueous extract from *Lemna minor* L. (duckweed) in alleviating the harmful effects of salt stress in olive plants (cv. Arbequina) grown in hydroponic systems. The application of duckweed extract resulted in a notable recovery in olive plant functionality and mitigated the detrimental effects of salt stress. Such a result highlights the biostimulant's ability to enhance physiological and biometric traits, including improved photosynthetic activity and stomatal conductance. In addressing the soil salinity issue, the effects of foliar-applied biostimulants on Chinese silver grass plants under salt stress conditions were investigated [4]. The author of this research demonstrated the efficacy of biostimulants on enhancing physiological properties and alleviating the adverse effects of salinity stress, thereby contributing to sustainable farming practices. The critical mechanisms underlying mung bean tolerance to salt stress facilitated by silicon application were elucidated in another study [5]. In this frame, the role of silicon in enhancing antioxidant capacity and proteomes has been revealed, thereby mitigating the adverse effects of salinity stress on mung bean plants [5].

Similarly, the use of three different commercial organo-mineral fertilizers with biostimulating action on young almond trees in semiarid climates was explored [6]. Despite adverse weather conditions in certain years, biostimulant treatments exhibited enhanced vegetative and reproductive performance, emphasizing the potential of biofertilizers to improve soil fertility and crop productivity.

Aquaponics, an integrated agri-aquaculture system, offers a unique approach to improving crop quality and bioactive compound content in medicinal plants. In this context, the modification of bioactive compound concentrations in Cuphea spp. irrigated with aquaponic waters was explored, highlighting the potential of aquaponics in promoting the biostimulation of medicinal plants [7].

Understanding the impact of weather variables on crop yields is crucial for sustainable farming practices. The influence of weather events on winter wheat yields, emphasizing the significance of extreme weather events, such as heat waves and dry periods, in affecting crop productivity, was examined [8]. The study's main finding was that in the observation period, years with reduced yield, compared with a multiannual trend, were frequently well explained by extreme weather events.

Furthermore, the detrimental environmental impacts of pesticide use in agriculture necessitate the exploration of alternative biostimulants. To this end, the biostimulant effect of mannosylerythritol lipids (MELs) on lettuce germination and growth was evaluated, highlighting their potential as eco-friendly alternatives to chemical pesticides [9].

In addition, the use of beneficial microorganisms, such as plant growth-promoting rhizobacteria (PGPR) and mycorrhizal fungi, holds promise for improving crop productivity and resilience. The effects of PGPR-based products on snap bean yield and quality were evaluated, highlighting their potential to regenerate soils and enhance crop productivity in organic farming systems [10].

From a circular economy perspective, an aqueous extract was obtained from a non-food and invasive species (duckweed) rich in bioactive compounds and used to biostimulate young tomato plants [11]. The results showed that the extract improved the activity and functionality of photosystems I and II, the linear flow of electrons, and the electrochemical gradient across the thylakoid membrane. In particular, the photosystems of the treated plants showed a greater ability to use light for biochemical and biosynthetic purposes, reducing the amount of radiation dissipated as heat, which is potentially toxic to chloroplasts and capable of triggering oxidative stress. These benefits justified the increases in aerial biomass production and root phenotyping, which, again, showed benefits promoted by the extract. The extract also induced pigment content and some metabolic clusters of interest.

Finally, a review synthesizes the existing literature to highlight the positive aspects of intercropping in nut production, as well as the challenges and limitations faced in different regions regarding agricultural production [12]. Indeed, it should not be underestimated that both the global population growth and intensive agriculture have had detrimental effects on the environment. Consequently, there is a growing interest in sustainable alternatives to promote better use of natural resources and create a balance between agriculture and the environment. In this context, intercropping aims to optimize land use economically while enhancing biodiversity through plant–microorganism interactions, thereby increasing crop productivity.

3. Conclusions

The Special Issue of *Agriculture*, "Abiotic Stresses, Biostimulants, and Plant Activity—Series II" highlights that the integration of biostimulant uses and sustainable practices in agriculture offers promising solutions for mitigating abiotic stresses, enhancing crop productivity, and promoting environmental sustainability. Research on this topic and the adoption of these innovative approaches are essential for building resilient and sustainable food systems that meet the challenges of global agriculture. The academic editors of this Special Issue hope that the collected articles will substantially enhance our understanding and spur additional exploration in this pivotal domain, essential for the future of agriculture, particularly in light of ongoing climate change, which is predicted to intensify the impacts of abiotic stresses on crops.

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