Supplementary Material

# Supplementary Data

**Supplementary Data 1.** Studies included for meta-analysis.

**Supplementary Data 2.** Dataset collected for meta-analysis.

# Supplementary Figures and Tables

## Supplementary Figures

**Supplementary Figure 1.** PRISMA 2020 flow diagram.

It was provided as a separate file.



**Supplementary Figure 2.** Contour-enhanced funnel plot for publication bias based on the standard errors in the random-effect models of 187 studies used in this meta-analysis. Each point represents the standard error located in distinct levels of confidence limits for a single study. Asymmetry analysis of Egger's test is indicated at the bottom left, where *p* > 0.001 means there is no evidence for asymmetry.

## Supplementary Figures and Tables

**Supplementary Table 1.** The biostimulant categories used in this meta-analysis according to the substance resources, adapted from (Du Jardin, 2015).

|  |  |  |  |
| --- | --- | --- | --- |
| **Biostimulant Category** | **Natural resources/substances** | **Bioactive compounds** | **Reference** |
| Chitosan (Chi) | Shrimp or crab shells | Co-polymers of N-acetyl-d-glucosamine and d-glucosamine | Reviewed in (Pichyangkura and Chadchawan, 2015) |
| Humic and fulvic acids (HFA) | plant and animal matter, and microbial metabolism  | humic acids and fulvic acids | Reviewed in (Canellas et al., 2015) |
| Protein hydrolysates (PHs) | Both animal and plant biomass | peptides and free amino acids | Reviewed in (Colla et al., 2015) |
| Phosphites (Phi) | P-containing nutrients | phosphite (Phi; H2PO3−) or its conjugate phosphorous acid (H3PO3) | Reviewed in (Gómez-Merino and Trejo-Téllez, 2015) |
| Seaweed extracts (SWE) | Red, green, and brown macroalgae species | Primary metabolites, i.e., carbohydrates, proteins, and amino acids  | Reviewed in (Chiaiese et al., 2018) |
| Silicon (Si) | biogenic silica soils | monomeric silicic acid (H4SiO4) | Reviewed in (Savvas and Ntatsi, 2015) |
| Plant extract (PE) | Plant tissues except for seaweed and others aiming for HFA and PHs | Various plant metabolites | Reviewed in (Ali et al., 2020) |

# Reference

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