



Food and Agriculture
Organization of the
United Nations

COMMISSION ON
GENETIC RESOURCES
FOR FOOD AND
AGRICULTURE



Convention on
Biological Diversity



Open-ended workshop on biological control agents and biostimulants

Abiotic Stress and Climate Change: Strengthening Crop Resilience with Biostimulants

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European Biostimulants Industry Council*



European Biostimulants Industry Council (EBIC)

70 member companies

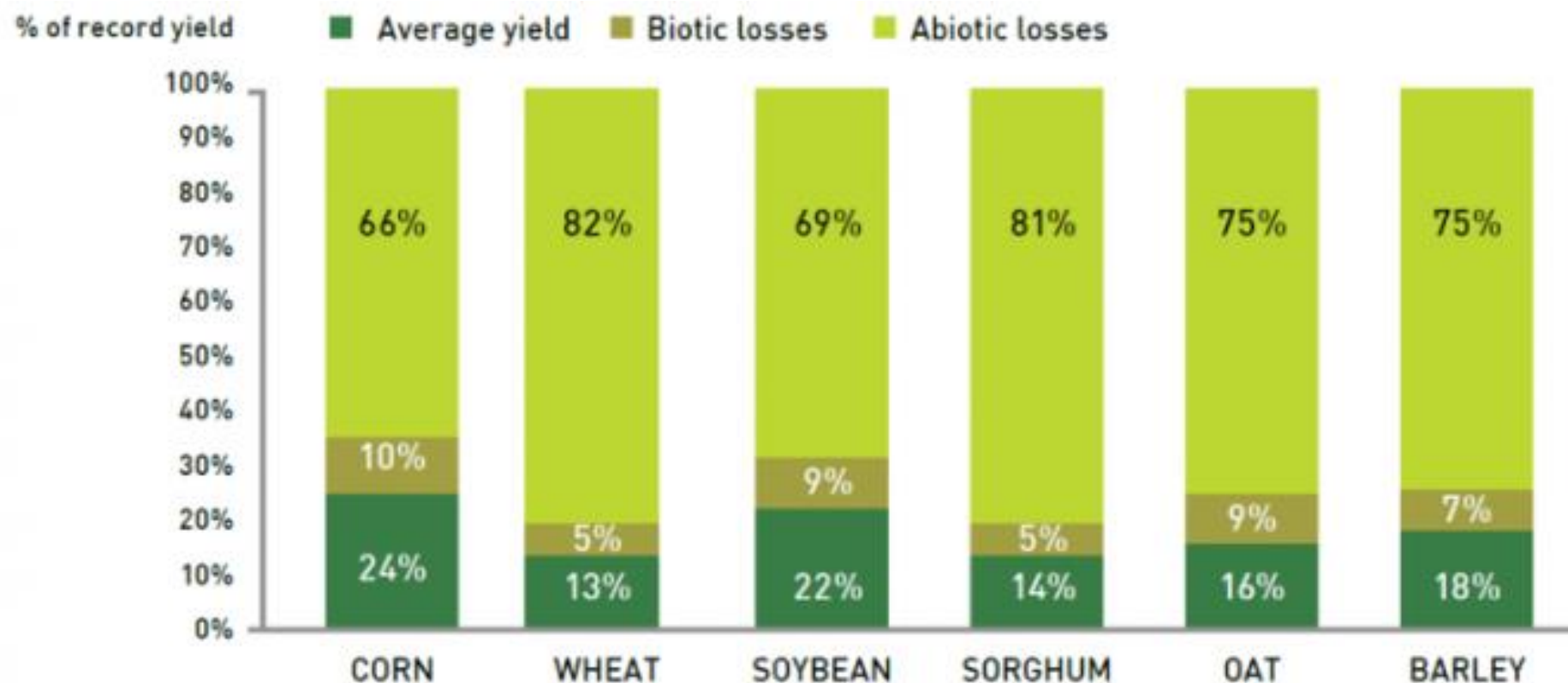
Breakdown by size (based on global turnover and headcount)



As of January, 24 2024

Mission: To ensure biostimulant technologies are valued as **integral to sustainable agriculture**, while securing an **enabling regulatory framework** for all biostimulant products.

Addressing the Real Threat to Global Food Security



YIELD GAP ANALYSIS

>70%

ABIOTIC LOSSES

<10%

BIOTIC LOSSES

Source: Buchanan, Gruissem, Jones: Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, 2000

Climate Change Exacerbates Abiotic Stress

- **Record Temperatures in 2023:** The highest temperatures on record, driving extreme weather events like droughts, floods, and storms.
- **Increasing Agricultural Risks:** Water scarcity, salinity, and flooding disrupt food production, threatening global food security.
- **Future Impact:** According to the IPCC, **cereal prices could rise by up to 30% by 2050** due to climate change, putting millions at risk of hunger.
- **FAO 2023 Report:** Highlights the **urgent need for investment in resilience** and adaptation to safeguard agricultural productivity.

Source: FAO (2023). The Impact of Disasters on Agriculture and Food Security: Investing in Resilience and Adaptation. Available at: <https://openknowledge.fao.org/bitstreams/55723930-635c-4f47-87eb-930fb0bbe0db/download>.

What are Biostimulants?

- Unlike traditional fertilisers and pesticides, plant biostimulants are **defined by their function**, not by their composition.
- with the sole aim of **improving one or more of the following characteristics** of the plant or the plant rhizosphere:
 - a) nutrient use efficiency,
 - b) tolerance to abiotic stress,
 - c) quality traits, or
 - d) availability of confined nutrients in the soil or rhizosphere.'

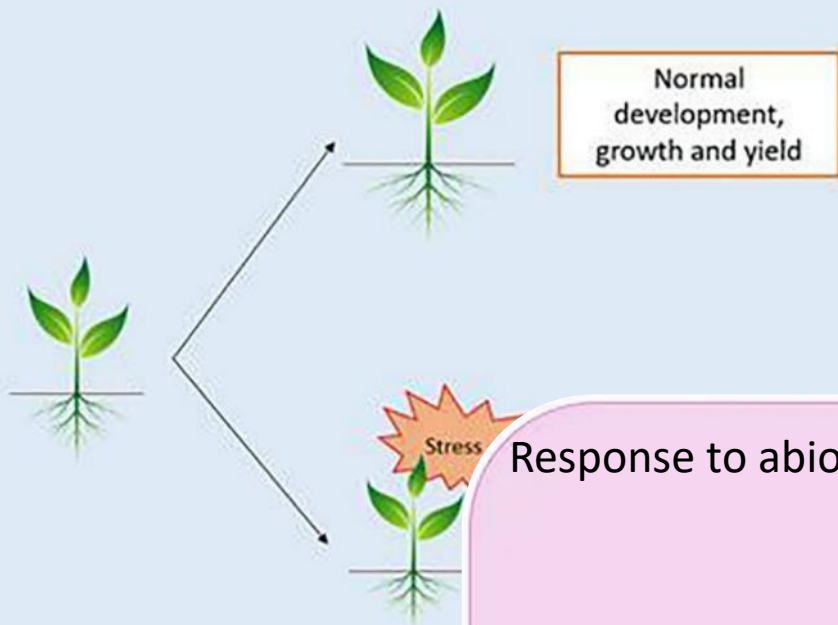
Microbial plant biostimulants:

Azotobacter spp., mycorrhizal fungi, *Rhizobium* spp., *Azospirillum* spp.

Non-microbial plant biostimulants:

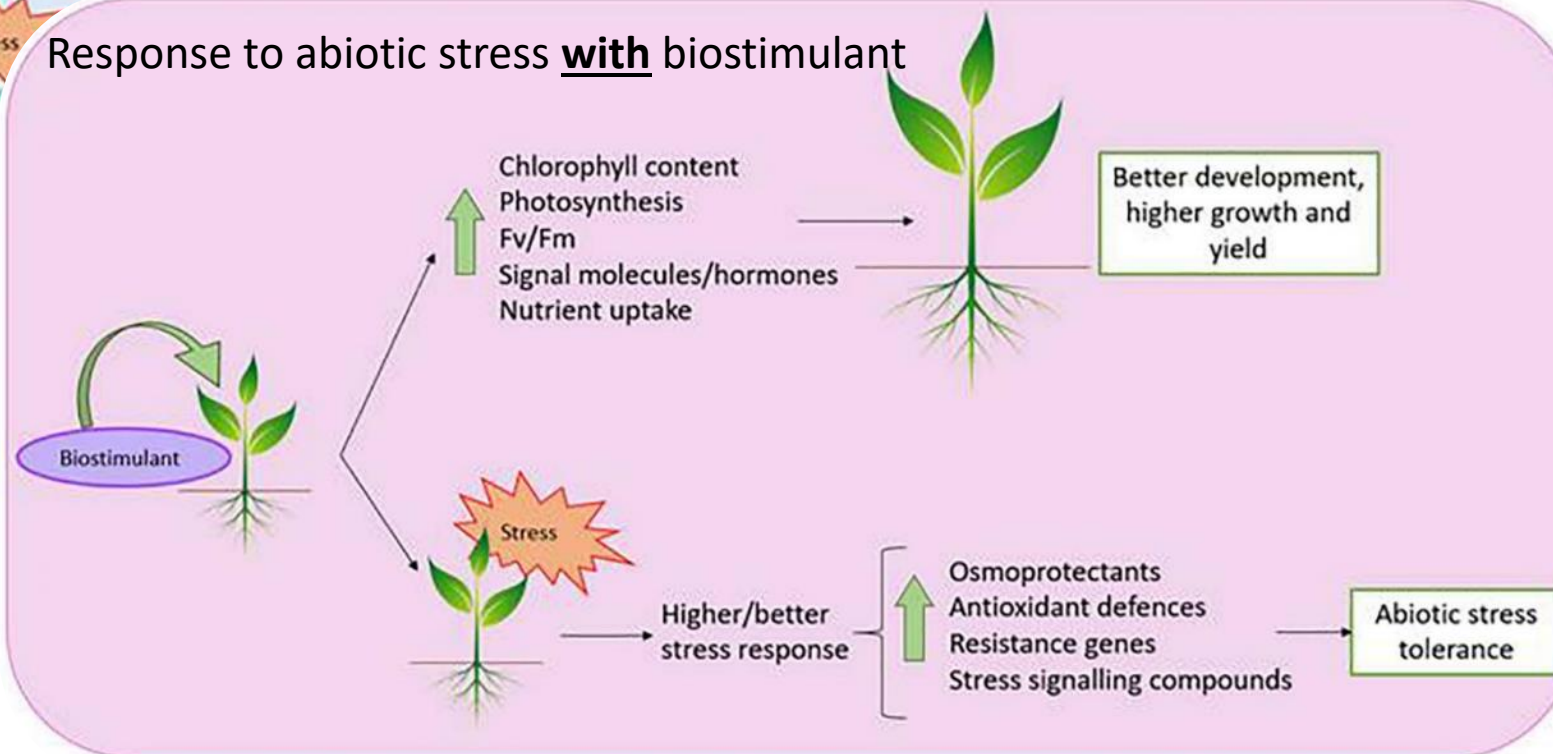
Plant extracts, seaweed extracts, humic substances, chemical substances, amino acids, animal by products, etc.

Response to abiotic stress without biostimulant



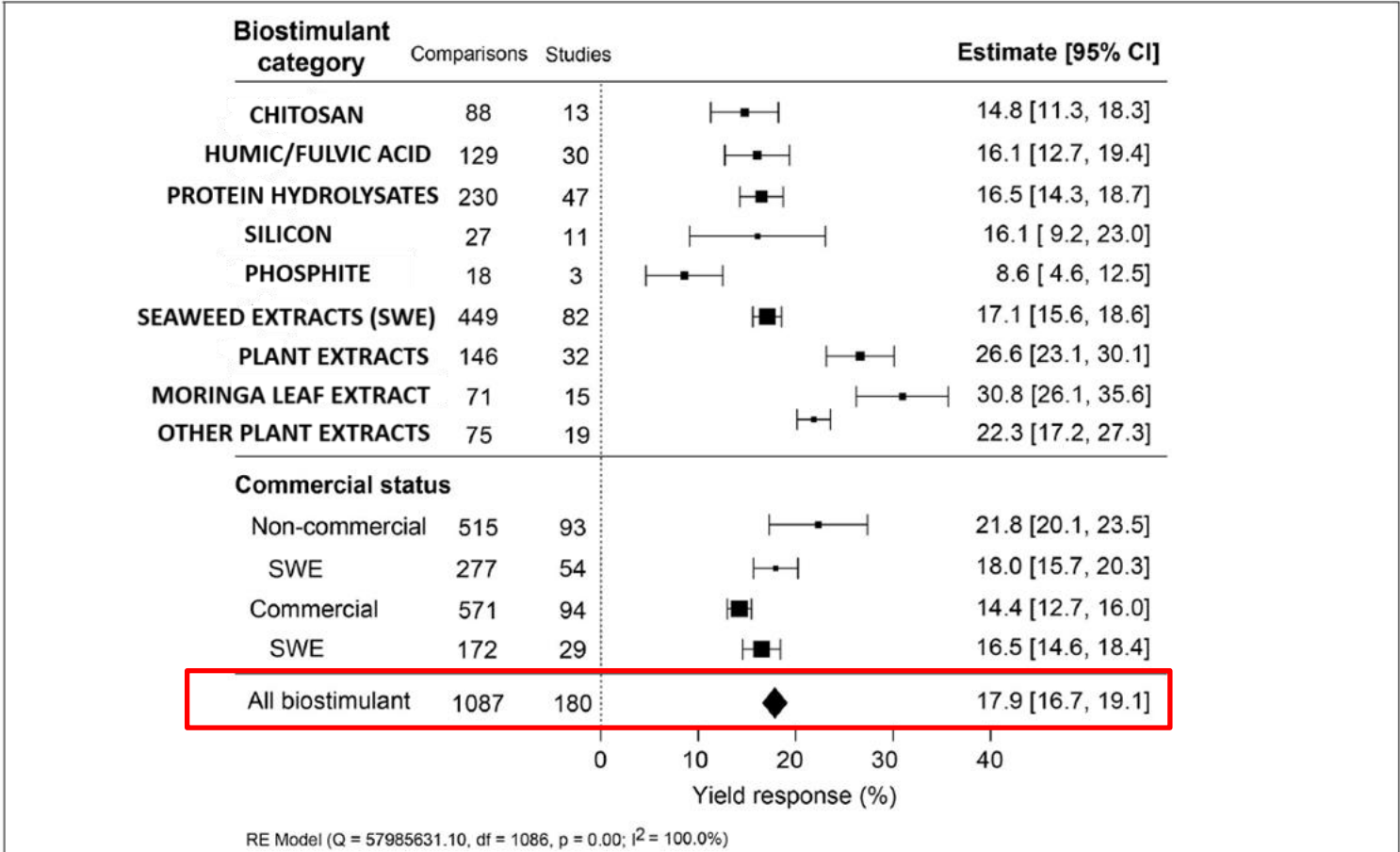
How Biostimulants Build Resilience Against Abiotic Stress

Response to abiotic stress with biostimulant



Source: García-García et al. (2020) Front. Plant Sci. 11: 575829

Validated Yield Gains from Biostimulants

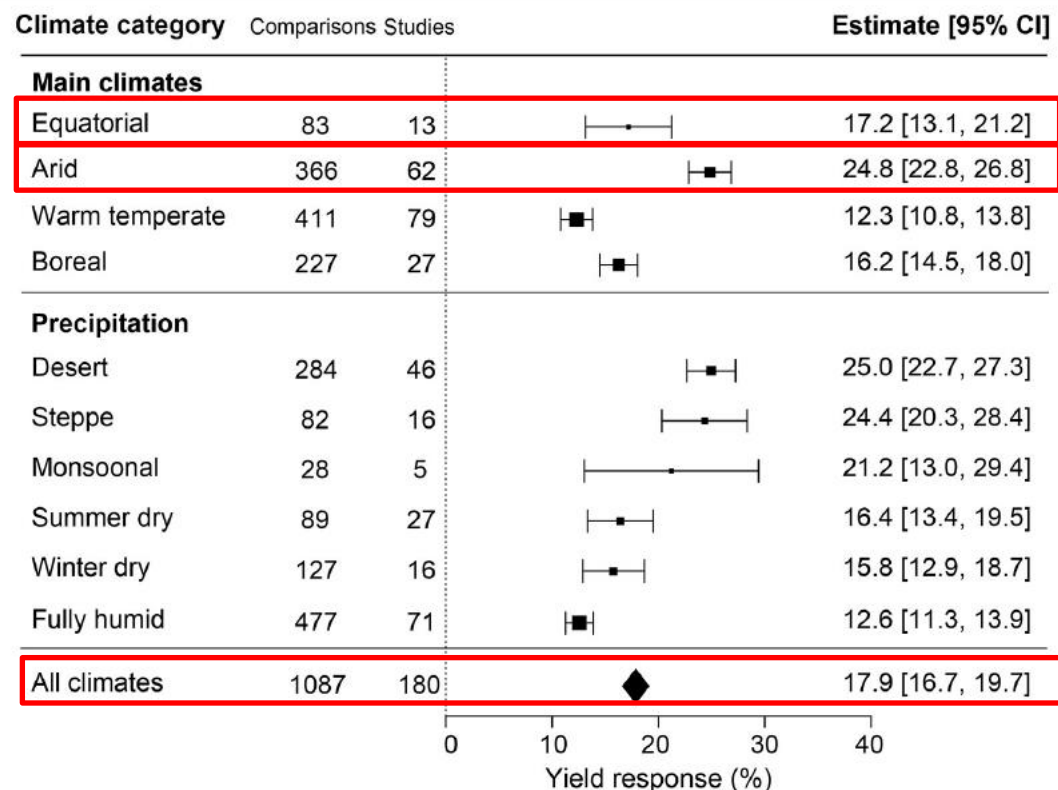


- **Average Yield Increase: 17.9%** across diverse conditions.
- **Study Scope: 1,000+ paired observations** from **180 trials**.
- **Crop types:** cereals, legumes, tubers, fruit and vegetables.
- **Global Reach:** Conducted in **various climates** worldwide.

Source: Li et al. (2022), *Frontiers in Plant Science*. [Read More](#).

FIGURE 2 | Percentage yield response to biostimulant application affected by the biostimulant category and the commercial status of biostimulant products. The point size correlates to the estimate's precision, and the error bars represent 95% confidence intervals (CI) of mean estimated effect sizes. The number of comparisons and studies is indicated in each line. The combined effect estimates and the heterogeneity test on the random-effect model (RE) are summarized at the bottom, where the heterogeneity test is significant ($p < 0.001$) and $I^2 \geq 75\%$ implies substantial heterogeneity. Chi, Chitosan; HFA, humic and fulvic acids; PHs, protein hydrolysates; Si, silicon; Phi, phosphite; SWE, seaweed extracts; PE, plant extracts; MLE, moringa leaf extract.

Superior Performance in Arid and Stressed Conditions



RE Model (Q = 57985994.60, df = 1086, p = 0.00; $I^2 = 100.0\%$)

FIGURE 5 | Percentage yield response to biostimulant application affected by the climate categories that were subgrouped into main climates and precipitation types. The point size correlates to the estimate's precision, and the error bars represent 95% confidence intervals (CI) of mean estimated effect sizes. The number of comparisons and studies is indicated in each line. The combined effect estimates and the heterogeneity test on the random-effect model (RE) were summarized at the bottom, where the heterogeneity test is significant ($p < 0.001$) and $I^2 \geq 75\%$ implies substantial heterogeneity.

- **Arid Regions:** Up to **25% yield** boost in drought-prone areas.
- **Equatorial Climates:** Supports resilience in high temperature and humidity.
- **FAO Focus:** Key for food security in vulnerable regions.

Source: Li et al. (2022), *Frontiers in Plant Science*. [Read More](#).

Beyond Yield: Enhancing Fruit Quality & Grower Income

Plant biostimulants are also proven to:

- **Enhance Nutritional Quality:**
 - Increases vitamins, antioxidants, and phenolic compounds ([Dasgan et al., 2024](#)).
- **Improve Physical Appearance:**
 - Enhances fruit size, colour, and firmness, making produce more attractive and marketable ([Colla et al., 2017](#)).
- **Extend Shelf Life:**
 - Reduces losses before and after harvest ([Rojas-Rodrigues et al., 2023](#)).
- **Enhancing fruit quality and grower income, while supporting a resilient food system**



Addressing the abiotic stress-induced yield gap with tools like biostimulants is paramount for global food security



- While pest and disease control remain vital, the disproportionate impact of abiotic stress demands a shift in focus towards strategies that **enhance plant resilience**.
- Biostimulants represent a key technology in this endeavour, offering a sustainable approach to **safeguard crop yields and quality** in the face of escalating environmental challenges.
- By integrating biostimulants into broader agricultural practices, we can **better equip farmers to meet the demands of a growing population while preserving the environment**.



Thank you for your attention

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