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Influence of Plant Growth Regulators on Eggplant Yield and Uniformity

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Abstract Eggplant production often faces problems such as unstable fruit set, yield fluctuation, and poor fruit uniformity. Plant growth regulators have therefore become an important regulatory tool for improving commercial production efficiency. This study discusses the effects of plant growth regulators on eggplant yield and uniformity, with particular emphasis on their roles in promoting flowering and fruit set, increasing fruit number per plant, improving single-fruit weight, and enhancing fruit shape and ripening synchrony. The results indicate that regulators such as GA_3 and NAA can significantly improve yield components, whereas 6-BA, SA, and EBR are more effective in alleviating abiotic stress, maintaining growth continuity, and enhancing fruit uniformity. Overall, plant growth regulators can achieve coordinated improvements in yield increase, yield stability, and quality enhancement when applied at appropriate concentrations and developmental stages. This study provides a theoretical basis and practical reference for precision cultivation of eggplant, the scientific application of growth regulators, and the management of commercial production.

Keywords Eggplant; Plant growth regulators; Yield; fruit uniformity; Fruit set rate; Stress regulation

1 Introduction

Eggplant (*Solanum melongena* L.) ranks among the most economically important solanaceous vegetables, after crops like tomato and potato, and is widely cultivated across tropical and temperate regions (Oladosu et al., 2021; Shi et al., 2023). Large germplasm collections and active breeding programs underscore its global significance for food systems and markets (Oladosu et al., 2021). Demand is rising due to its culinary versatility, nutritional value, and year-round availability, yet regional production often remains below potential because of land, climate, and management constraints (Alicja et al., 2019; Rathore et al., 2022).

For both consumers and producers, yield, fruit size, shape, and external appearance are key agronomic and commercial traits (Taher et al., 2017; Alicja et al., 2019). Uniform fruit length, diameter, weight, and shape improve grading, packaging, and price, while non-uniformity leads to higher discard rates and economic loss (Wakchaure et al., 2020; Rathore et al., 2022). Environmental stresses, nutrient imbalances, and irregular fruit set frequently compromise both total yield and fruit uniformity (Wakchaure et al., 2020; Rathore et al., 2022).

Plant growth regulators are organic compounds, distinct from nutrients, that regulate plant growth and development at very low concentrations (Bons and Kaur, 2019; Zahid et al., 2022; Amin et al., 2025). They include endogenous hormones and synthetic analogues such as auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, jasmonates, and salicylic acid (Zahid et al., 2022; Amin et al., 2025). Through modulation of cell division, elongation, flowering, fruit set, and stress responses, PGRs have become key tools in modern vegetable production systems. In vegetables, PGRs are used to improve seedling vigor, flowering, fruit set, retention, and final yield, and to alleviate abiotic stresses like drought, salinity, and temperature extremes (Wakchaure et al., 2020; Zahid et al., 2022; Verma et al., 2024). In eggplant, foliar or floral applications of auxin-like compounds (e.g., NAA, 4-CPA, cloxyfonac), gibberellins, and other regulators can significantly increase fruit set, number of fruits per plant, and marketable yield, sometimes without changing cultural practices