Computational Molecular Biology 2026, Vol.16, No.3, 146-158
http://bioscipublisher.com/index.php/cmb

Review Article Open Access

Prediction of Eggplant Yield Based on Fertilization and Climate Variables

Guifang Li
1 Jiande Qingrun Modern Agriculture Development Co., Ltd., Jiande 311600, Zhejiang, China
2 Zhejiang Agronomist College, Hangzhou 310021, Zhejiang, China
Corresponding author: 18179387545@163.com
Computational Molecular Biology, 2026, Vol.16, No.3 doi: 10.5376/cmb.2026.16.0011
Received: 24 Mar., 2026
Accepted: 28 Apr., 2026
Published: 12 May, 2026

Preferred citation for this article:
Li G.F., 2026, Prediction of eggplant yield based on fertilization and climate variables, Computational Molecular Biology, 16(3): 146-158 (doi: 10.5376/cmb.2026.16.0011)

Abstract With the intensification of climate change and the continuous transformation of agricultural production methods, the extent to which eggplant yields are jointly influenced by fertilizer management and climatic conditions has become increasingly evident. Focusing on fertilization factors and climatic variables as the core subjects of inquiry, this study systematically analyzes the mechanisms by which temperature, precipitation, humidity, and fertilizer inputs affect eggplant yield formation, while also exploring the interactive effects between climate and fertilization. To this end, regional meteorological data, soil nutrient data, and field yield data were collected to construct an eggplant yield prediction model based on a combination of statistical analysis and machine learning techniques. The research focuses on variable selection, feature engineering, model training, and the optimization of predictive performance, while also comparing the differences in predictive accuracy and stability between regression models and machine learning algorithms. The results indicate that temperature fluctuations, soil moisture conditions, and nitrogen fertilizer inputs are critical factors influencing eggplant yields, and that the coupled effects of these multiple factors can significantly enhance the accuracy of the prediction model. A case study further validates the model's applicability within regional agricultural production contexts, providing a scientific basis for precision fertilization management, agricultural risk assessment, and smart farming decision-making. This study holds significant theoretical and practical implications for improving eggplant production efficiency, optimizing resource utilization, and fostering sustainable agricultural development.
Keywords Eggplant yield prediction; Fertilization management; Climate variables; Machine learning; Precision agriculture

1 Introduction

Eggplant (*Solanum melongena* L.) is a widely cultivated vegetable valued for its nutritional quality, including minerals, vitamins, and antioxidant phenolics that contribute to human health and dietary diversity (Başay et al., 2025). It also plays an important economic role, providing income for smallholders and contributing substantially to vegetable production in many countries, yet yields in several regions remain below global averages (Oladosu et al., 2021; Dollison and Tapas, 2024). At the same time, agriculture faces mounting pressure from climate change, with shifts in temperature and rainfall patterns already constraining productivity and threatening food and nutrition security, especially in vulnerable regions (Chioti et al., 2022; Kuradusenge et al., 2023). In this context, improving the stability and predictability of eggplant yield under varying fertilization regimes and climate conditions is critical for both farmers' livelihoods and broader food system resilience.

Fertilization management is a central lever for enhancing eggplant productivity, fruit quality, and nutritional value. Numerous studies show that optimizing macro- and micronutrient supply-through mineral NPK fertilizers, organic amendments, and foliar micronutrients-can significantly increase growth, yield components, and nutrient content of eggplant fruits and seeds (Bana et al., 2022). Integrated nutrient management approaches, combining chemical fertilizers with biofertilizers and micronutrients, have further improved yield and quality, and have been successfully modeled using data-driven techniques such as artificial neural networks to identify key nutritional predictors of yield and protein content (Thingujam et al., 2020). However, many fertilization recommendations are still static, and rarely account for interactions with variable weather, despite the fact that fertilization efficiency and crop response can be strongly modulated by temperature and moisture regimes (Gad, 2023; Chandio et al., 2025).