Tropentag, September 16-18, 2026, hybrid conference

"Towards multi-functional agro-ecosystems
promoting climate resilient futures"

Modelling the impact of climatic variability and heat stress on olive productivity in Lattakia, Syria

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Abstract

This study provides a comprehensive econometric analysis of the relationship between climatic variability and olive productivity (*Olea europaea*) in Lattakia Governorate, Syria, spanning more than two decades (2002–2024). Utilizing high-resolution climatic data from the NASA POWER platform integrated with local agricultural records, the research employs the Newey-West estimator. This methodology was specifically chosen to ensure statistical robustness by effectively addressing issues of autocorrelation and heteroskedasticity inherent in long-term time-series agricultural data.

The empirical results confirm that alternate bearing (the biological on-off cycle) remains the primary and most significant determinant of annual productivity fluctuations. From a climatic perspective, the model reveals a statistically significant negative impact of spring rainfall on olive yields. This phenomenon is scientifically attributed to excessive moisture levels during the critical flowering and fruit-setting stages, which physically interferes with wind pollination and creates a highly conducive environment for fungal pathogens, most notably Olive Peacock Spot (*Spilocaea oleagina*).

Furthermore, regarding qualitative indicators of production, the analysis identified a distinct negative correlation between autumn rainfall and oil percentage. The findings suggest that late-season precipitation leads to a dilution effect, where increased fruit water content occurs at the expense of oil concentration, complicating the extraction process. Crucially, the study detected a significant long-term upward trend in May maximum temperatures, rising by 0.09 °C per year. This warming trend signals escalating future risks associated with heat stress during the sensitive reproductive phase.

The study recommends establishing integrated early warning systems for spring humidity management and enhancing phytosanitary strategies against fungal diseases. Additionally, it advocates for optimising harvest timing to adapt to shifting autumn precipitation patterns, ensuring both oil quality and the long-term sustainability of olive production in the Mediterranean coastal region.

Keywords: Alternate bearing, climate variability, Lattakia, Newey-West Model, oil content, *Olea europaea*, spring heat stress

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