

**Mathematical Methods and Models in Biosciences**

June 15–20, 2025, Sofia, Bulgaria

<https://biomath.math.bas.bg/biomath/index.php/bmcs>

## Mathematical modeling and eco-friendly management of the population dynamic of Fall Armyworm, *Spodoptera frugiperda*, under climatic variations

Gabriel Kolaye, Michael Chapwanya

Department of Mathematics and Applied Mathematics,  
Faculty of Natural and Agricultural Sciences,  
University of Pretoria, South Africa

kolaye.gabriel@up.ac.za

m.chapwanya@up.ac.za

The Fall Armyworm (*Spodoptera frugiperda*) is a highly invasive pest that poses a significant threat to staple crops, particularly maize, across tropical and subtropical regions. Its rapid spread and resilience are exacerbated by climate variability and unsustainable control strategies. In this study, we develop a mathematical model to investigate the population dynamics of Fall Armyworm under varying climatic conditions, with a focus on temperature and rainfall influences. The model incorporates eco-friendly pest management strategies, such as biological control and crop rotation, to evaluate their effectiveness in reducing pest outbreaks while preserving ecological balance. Sensitivity analysis is performed to identify key parameters driving population growth and to assess the robustness of control strategies under climatic uncertainty. Numerical simulations highlight critical thresholds for pest suppression and suggest optimal timing for intervention. This research provides valuable insights for the sustainable management of Fall Armyworm and supports informed decision-making in pest control policies under climate change scenarios.

*Keywords: fall armyworm, maize, eco-friendly pest management strategies, varying climatic conditions, control strategies*

### References

- [1] G. Goergen, P. L. Kumar, S. B. Sankung, A. Togola, M. Tamò, First Report of Outbreaks of the Fall Armyworm *Spodoptera frugiperda* (J E Smith) (Lepidoptera, Noctuidae), a New Alien Invasive Pest in West and Central Africa, *PLOS ONE* 11:e0165632, 2016.
- [2] R. Day, P. Abrahams, M. Bateman, T. Beale, V. Clottey, M. Cock, Y. Colmenarez, N. Corniani, R. Early, J. Godwin, J. Gomez, P. G. Moreno, et al., Fall Armyworm: Impacts and Implications for Africa, *Outlooks on Pest Management*, 28:196–201, 2017.