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From nematode nightmare to yield triumph? Evaluating biological agents’ effect on lettuce cultivation in Costa-Rica

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Abstract

Biofertilisers and biocontrol agents, consisting of microbial strains such as fungi, bacteria, or algae, can supply essential nutrients to plants and mitigate pest damage. These agents are crucial for reducing the environmental impact of chemical fertilisers and pesticides, while promoting disease control, improving soil structure, and enhancing plant growth. This study evaluated the effectiveness of three biological products – Fertibiol, Trichobiol, and Nematobiol – in increasing the fresh matter (FM) yield of lettuce and limiting root-knot nematode (*Meloidogyne* spp.) damage, using two pot trials. The biofertiliser Fertibiol contains the bacteria *Bacillus subtilis*, *Bacillus amyloliquefaciens*, *Pseudomonas fluorescens* and *Azotobacter chroococcum*. Trichobiol, used as both biofertiliser and biocontrol agent, includes the fungal species *Trichoderma asperellum*, *T. asperelloides*, and *T. guizhouense*. Nematobiol is a bionematicide containing the fungus *Paecilomyces lilacinus*. The trials, using a randomised block design with four replications, were conducted in the organic community garden of the Universidad Bíblica Latinoamericana (UBL) in San José, Costa Rica. Nematode pressure was high in the first trial, but relatively low in the second, as revealed by examination of the roots and soil samples. In the first trial, none of the treatments significantly increased the FM yield compared to the control. In the second trial, Fertibiol even resulted in a significantly lower FM yield than the control. Consequently, none of the three biological products significantly increased the lettuce FM yield overall. However, under high disease and nematode pressure in the first trial, both Fertibiol and Nematobiol showed a trend toward increased FM yield, suggesting potential benefits under stressful conditions. The nematode infestation of lettuce roots, estimated in the second trial by eight assessors using the average galling index, was similar across all treatments and the control, ranging from 2 to 3, indicating that the organic products had little effect on galling index under relatively low nematode pressure. In conclusion, the three biological agents had limited impact on lettuce yield and nematode damage under optimal conditions. However, their potential under stress conditions — such as high nematode infestation and disease pressure — warrants further investigation.

Keywords: Biofertiliser, bionematicide, Costa Rica, galling index, lettuce, *Meloidogyne*, yield