# Effect of Biofumigation on *Meloidogyne incognita* and Microbial Biomass Carbon in Tomato Cultivation

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Biofumigation using cruciferous crop residues provides an eco-friendly and sustainable method for managing *Meloidogyne incognita* and improving soil health in tomato cultivation. This study evaluated the comparative efficacy of mustard, cabbage, cauliflower, and radish residues applied at 0.5%, 1%, and 2% w/w, along with *Pochonia chlamydosporia*-enriched farmyard manure (FYM) and a chemical nematicide (Velum Prime, Fluopyram 34.48% SC). The incorporation of residues significantly ($p \leq 0.05$) reduced nematode infection and reproduction parameters. Among the treatments, mustard at 2% w/w recorded the highest reduction in gall formation (93%) and egg masses (89%) per plant. Principal Component Analysis (PCA) distinctly grouped the high-dose biofumigant treatments (2% w/w) as most effective, with lower infection levels, while 1% applications also showed statistically similar effects in many parameters. Plant growth parameters such as height, shoot and root length, and biomass were significantly enhanced by biofumigation, particularly with mustard at 1% and *P. chlamydosporia*-enriched FYM. Soil microbial health was also influenced by the treatments. The highest microbial biomass carbon (MBC) was recorded in *P. chlamydosporia* treatment (310 µg/g), followed by 1% biofumigation treatments (255–285 µg/g), indicating microbial stimulation. However, 2% w/w application slightly reduced MBC (215–230 µg/g), while Velum Prime recorded the lowest (180 µg/g), suggesting suppression of microbial activity. Dehydrogenase enzyme activity followed a similar trend, with the highest activity in *P. chlamydosporia* (70 µg/g) and the lowest in Velum Prime (41 µg/g). Overall, 1% biofumigation and *P. chlamydosporia*-FYM were most effective in suppressing *M. incognita* and improving plant and soil health, highlighting their potential for integrated PPN management.

**Keywords**: Biofumigation, Dehydrogenase enzyme, Microbial biomass, *Pochonia chlamydosporia,* Root-knot nematode