Combating Root-Knot (Meloidogyne spp.) and Fusarium oxysporum With Stabilized Allicin (Allium sativum) and siRNA Constructs

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Meloidogyne spp., or the root-knot nematode, is the most destructive nematode disease worldwide and persists in threatening the sustainability of the vegetable industry in numerous regions. Currently, no environmentally green pesticide is registered to cure this disease and preserve plant health. Fusarium Wilt (Fusarium oxysporum) is a fungal vascular root disease with no registered cure, causing a 95% yield reduction in Cavendish bananas. In this experiment, allicin (Allium sativum) was used to treat root-knot-infected soil, with Velum (Fluopyram) as the standard control. Allicin has a fast degradation rate, chitosan encapsulation was performed to enhance efficacy. Oligonucleotides were designed to silence the virulence factor Secreted in Xylem 1 (SIX1) in Fusarium Wilt. Root gall index through visual measurements showed a 54.55% decrease, confirmed with plant vigor physical measurement where the plant height increased by 15%. Soil porosity was used to measure the water retention of soil. The macropore content was higher in treated soil by 15%, respectively. Among the different concentrations (100 μM, 500 μM, 2 mM, 5 mM) of allicin, 2 mM was found to be optimal. Oligonucleotide sequence 2 demonstrated a TM of 56.2°C and 55.6% GC content. The siRNA conserved linear secondary structure, providing strong functionality. Based on the findings, allicin can be an effective and sustainable solution for root-knot management, supporting the global agriculture industry, while oligonucleotides have the potential for effective knockout of Fusarium Wilt virulence, with implications on the economy and food security.

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