



Nematode Damage in Crops: Identification, Impact, and Management Strategies

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Description

Nematodes, microscopic roundworms that inhabit soil, are among the most prevalent and economically significant pests affecting crops worldwide. Plant-parasitic nematodes feed on plant roots, causing a range of damage that impacts crop growth, yield, and quality. Their ability to inflict significant harm on agricultural systems makes understanding nematode damage, identifying their presence, and implementing effective management strategies critical for sustainable agriculture. This study provides an overview of nematode damage in crops, including methods for identification, the impact on agricultural productivity, and management strategies to mitigate their effects.

Nematodes cause characteristic root symptoms such as root galls (swelling), root knots, and lesions. These symptoms can be observed by inspecting the root system for abnormalities. Above-ground symptoms often include stunted growth, yellowing or wilting of leaves, reduced plant vigor, and poor fruit or seed development. These symptoms can resemble those caused by other pests or diseases, making accurate diagnosis essential. Examining plant roots for deformities, swelling, or necrotic lesions can provide clues to nematode damage. Galls and knots on roots are indicative of nematode infestation. Soil samples can be collected and analyzed for the presence of nematodes. Soil assays can reveal the population density and species of nematodes present. Techniques such as the Baermann funnel method, sieving, and decanting can be used to extract nematodes from soil and root samples for identification under a microscope. Observing nematode morphology, including size, shape and the presence of specialized structures (e.g., stylets), helps identify species. Taxonomic keys and expert consultation

may be necessary for precise identification. Molecular methods, such as DNA sequencing and Polymerase Chain Reaction (PCR), offer precise identification of nematode species and populations. These techniques can detect specific nematode genes and provide information on genetic diversity. Nematodes can reduce crop yields significantly by damaging plant roots and impairing nutrient and water uptake. Yield losses vary depending on the nematode species, infestation level, and crop type. Nematode damage can affect the quality of harvested produce, leading to lower market value. For example, nematode-induced root galls in vegetables can reduce their marketability. Increased production costs managing nematode infestations often requires additional expenditures on control measures, such as nematicides and soil treatments. These costs can impact the profitability of farming operations. Nematodes feed on plant roots, leading to reduced root mass, impaired root function, and increased susceptibility to secondary infections. Damaged roots hinder plant growth and nutrient uptake. Infested plants may exhibit reduced growth, wilting, and poor overall health. This can result in lower crop yields and decreased plant durability. Nematode activity can disrupt soil structure and microbial communities. For instance, nematode-induced root damage can lead to soil compaction and reduced microbial diversity, impacting soil health. Rotating crops with non-host plants can reduce nematode populations in the soil. Selecting crops that are less susceptible to specific nematode species helps break the nematode lifecycle. Planting nematode-resistant crop varieties can significantly reduce nematode damage. Resistance is achieved through breeding programs that incorporate nematode-resistant genes into crop cultivars. Maintaining good field sanitation practices, such as removing and destroying infected plant debris, can help reduce nematode populations and prevent their spread. Fungi such as *Paecilomyces lilacinus* and *Trichoderma* spp. can parasitize and kill nematodes in the soil. These fungi are applied as soil amendments to reduce nematode populations. Certain nematodes, such as *Steinernema* and *Heterorhabditis* species, prey on plant-parasitic nematodes. These predatory nematodes can be introduced into the soil to control nematode populations. Various chemical nematicides are available for controlling nematodes. These include fumigants, such as methyl bromide (though its use is restricted due to environmental concerns), and non-fumigant nematicides, such as those containing abamectin or oxamyl. Proper application and adherence to safety guidelines are essential for effective and safe use. Combining chemical control with other management strategies, such as cultural practices and biological control, provides a more sustainable approach to managing nematodes. Integrated Pest Management (IPM) focuses on reducing nematode populations while minimizing environmental impact. Adding organic materials, such as compost and green manures, can improve soil structure, enhance microbial diversity, and reduce nematode populations. Organic matter can also increase soil fertility and plant health.

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