Controlling *Nematodes* for Sustainable Agriculture and Food Production

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Editorial

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DESCRIPTION

The use and potential of Entomopathogenic *Nematodes* (EPNs) as a biological control agent in sustainable food production across a wide range of agricultural and other commodities is the focus of this research. Certain actions can be adopted after the life history and behaviour of the pest are identified when contemplating prospective nematode management measures. Plant parasitic *nematodes* are most abundant in the rooting zones of crops, typically in the top 30 cm of soil; nevertheless, worms can reach deeper soil layers, especially in unfavourable conditions, before returning to the surface layers when crop growth starts. Some species' free-living stages, such as the potato-cyst nematode, survive the unfavourable season through physiological or structural adaptation, or live for numerous seasons as eggs.

When *nematodes* are actively hunting for host roots and surviving unfavourable growing seasons, they are normally at their most vulnerable. Free-living stages can survive longer without hosts than previously assumed and fallow periods of less than 12 months may be sufficient to manage species that reproduce quickly. Heat, desiccation and anaerobis are the key abiotic variables that influence free-living *nematodes* and eggs. Plant-parasitic *nematodes* cannot survive in temperatures above 40°C for lengthy periods of time. During the summer season, these temperatures may be attained on bare soil in some regions, however heat penetration may not extend below 10 cm.

Flooding has been proposed as a method of nematode management in some areas. When the soil is inundated, all of the pore spaces are filled, restricting the oxygen supply to the soil micro flora and fauna. Many plant-parasitic *nematodes* are oxygen-intolerant and die quickly. When *nematodes* are held in deep water in the laboratory, similar effects are observed, but they may often be resurrected by aeration. In order to be effective in the field, the anaerobiosis must last long enough to kill the *nematodes*. Banana farms in Cote d'Ivoire are flooded for at least five weeks. Flooding is not an extensively utilised nematode management strategy, and it is unknown whether it is equally effective against all plant-parasitic species.

The creation of nematode management techniques necessitates a thorough understanding of the host plant's growth and the nematode's biology. In some climates, avoiding harm can be accomplished by planting the crop at a time when nematode invasion is slow or when plant development is quicker than the parasite's. Seedlings produced in nematode-free nurseries or in soil-less potting media can reduce damage to transplanted short-cycle crops. In general, if a crop is protected from invasion during its early growth, it can generate a yield that is satisfactory to most farmers, even if it is planted in nematode-infested soil, as long as the crop is given appropriate water and nutrients. This will not prevent the growth of huge nematode populations on the root systems and in the soil, which will have an impact on the following crop.

Entomopathogenic *Nematodes* (EPNs) can control pests thanks to a mutualistic relationship with bacteria that cause septicemia in the host and create a favourable environment for EPN development and reproduction. The diversity of EPNs found in Brazilian soils warrants additional investigation. Because of their mutualistic connection with bacteria of the genus Xenorhabdus, Entomopathogenic *Nematodes* (EPNs) of the families Steinernematidae and Heterorhabditidae can suppress pests. These *nematodes* enter the host by natural openings or the cuticle, carrying bacteria into the hemocele where they proliferate and kill the host within 24 to 48 hours creating a suitable environment for nematode development and reproduction. When the insect host supplies run out, infective juveniles look for another host in the soil8. Due to the inefficiency of traditional chemical and cultural strategies for insect soil management, as well as the wide range of EPN hosts, interest in these biological control agents is growing.

Entomopathogenic *nematodes* are now created *in vivo* and *in vitro* using several ways. Each method offers advantages and disadvantages in terms of manufacturing costs, technological know-how, economies of scale, and product quality, and each method has the potential to be improved. Following manufacture, there are a range of formulation and application options. The goals of this review are to give a summary and analysis of elements that influence EPN production and application, as well as insight into how to improve techniques to achieve more biological control success.