Need for producing nematode free healthy papaya seedlings

Securing healthy papaya seedlings is essential to ensure optimum plant population stand, good growth and higher yields. Infestation by heavy populations of nematodes results in very weak seedlings with poor root growth. Nematode attack on the root system makes the seedlings weak, stunted and also vulnerable for the infection by secondary pathogens (soil borne fungi and bacteria). Further, nematode infected seedlings facilitate spread of the nematodes in the main fields making the problem more difficult to manage in a larger area. Because of these reasons it is essential to produce nematode free seedlings.

The solution

Integrated management of nematodes is the best option to manage nematodes in which more of beneficial organisms play a vital role in this direction the IIHR Bengaluru has identified few microorganisms which can successfully manage the nematode problem. The institution has identified two microorganisms and has come out with organic formulation

Patented Innovations

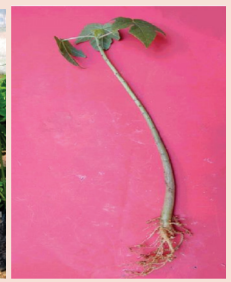
This organic formulation consists of *Pseudomonas fluorescens* and *Trichoderma harzianum*. Patents from 4 countries were granted for this innovation. United States (US) patent – No: US 7,923,005 B, Indian patent - No.250779, Australian patent – No. AU 2007216174 B2 and Thailand patent – No: 7621 (Dr. M. S. Rao, Principal Scientist, Division of Entomology & Nematology, & Dr. N. Ramachandran, Former Principal Scientist and Head, Division of Pathology, IIHR, Bengaluru hold these patents).

The institute has also developed mass production protocols of *Pseudomonas fluorescens* 1% W. P. (an effective bio-bactericide and also has nematicidal proper-ties), *Trichoderma harzianum*1% W. P. & *Trichoderma viride* 1.5 % W. P. (effective bio-fungicides and also have nematicidal properties), and *Paecilomyces lilacinus*1% W. P. & *Pochonia chlamydosporia* 1 % W. P. (effective bio- nematicides) under the leadership of Dr. M. S. Rao.

Methods for producing nematode free and healthy Papaya seedlings

One ton of soil mixture or any substrate (for papaya seedlings hardening) should be prepared by mixing 2 kg of each of *Pseudomonas fluorescens, Trichoderma harzianum* and *Paecilomyces lilacinus* or 2 kg organic formulation of bio-agents. + 5 kg of Furadon or Phorate or 25 kg of neem cake or pongamia cake. This soil mixture or any substrate can be used for producing papaya seedlings.

Untreated Seedling



Nematode Infested Seedling

Healthy Seedling Treated with Bio-Agent Formulations

Spraying

- ✓ These formulations (IIHR patented *Pseudomonas fluorescens* or patented formulations) can be sprayed on the seedlings by dissolving 5g formulation / lit of water once in 10 days

Application through drenching: These formulations (IIHR patented *Pseudomonas fluorescens, Trichoderma harzianum* or patented formulations) can be drenched in the substrate by dissolving 5g formulation / lit of water and this can be done once in 10 days.

Effects of substrate treatment with IIHR patented bio-pesticide formulation

- ✓ Helps in producing the nematode free, vigorous and healthy seedlings.
- ✓ Helps in promotion of growth of the seedlings.
- ✓ Because of ISR (Induced Systemic Resistance) effect, it helps in the management of pathogens if any are systemic.

How serious is this nematode and how does it spread

These nematodes are responsible for 15 to 25 percent yield losses in papaya. The incidence of wilt caused by fungus would be doubled in the presence of this nematode. The nematodes spread from one locality to other papaya seedlings. The nematodes are disseminated when water that drains from infested areas gets recycled into irrigation system. Soil that adheres to implements, tyres of motor vehicles and shoes of plantation workers may also spread nematode from one area to other area.

Where do these nematodes live

Maximum numbers of nematodes are present at a distance of 25 to 50 cm from the base of the plant and at a depth of 10 to 30 cm.

What symptoms these nematode produce

Basically these nematodes are parasites of underground roots. The root-knot nematode produces galls or knots on the roots. Nematode infestation on papaya roots manifests by varying degrees of retarded growth and leaf yellowing. With the increase in nematode population, feeder roots are invaded and destroyed as fast as they are formed. The resulting setback in the uptake of plant nutrients leads to debility of the plant and production of smaller fruits.

Methods of use of bio-agents or of patented organic formulations for growing a good crop of Papaya (These methods are useful for papaya plants which are to be planted or for a standing crop).

Soil application: Apply IIHR patented bio-pesticide or **patented organic formulation** enriched FYM@ 5kg or enriched neem cake@ 250g or enriched vermicompost@500g/plant at planting and at intervals of 6 months.

For standing crop apply IIHR patented bio-pesticide or **patented organic formulation** enriched FYM@ 5kg

or enriched neem cake @ 250g or enriched vermicompost @500g/plant at an interval of 6 months.

Enrichment of FYM

- 2 tons of well decomposed FYM has to be enriched by mixing with 5kg of formulation under shade. It has to be covered with mulch and optimum moisture of 30% has to be maintained for a period of 15 days.
- Once in a week thoroughly mix the FYM for maximum multiplication of and homogenous spread of the microorganisms in the entire lot of FYM.

Enrichment of Neem cake

- 1 ton of neem cake has to be enriched by mixing with 2kg of formulation under shade. It has to be covered with mulch and optimum moisture of 30% has to be maintained for a period of 15 days.
- Once in a week thoroughly mix the neem cake for maximum multiplication of and homogenous spread of the microorganisms in the entire lot of neem cake.

Enrichment of Vermicompost

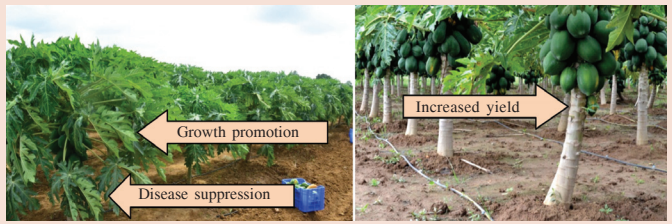
- 1 ton of vermicompost has to be enriched by mixing with 3kg of formulation under shade. It has to be covered with mulch and optimum moisture of 30% has to be maintained for a period of 15 days.
- Once in a week thoroughly mix the vermicompost for maximum multiplication of and homogenous spread of the microorganisms in the entire lot of vermicompost.

Spraying

The IIHR patented formulation can be sprayed on the plants at regular intervals of 30 days at a dosage of 5g/ lit.

Application through drip / drenching

The IIHR patented formulation can also be given through drip/ by drenching @ 5g/ lit. of water at regular interval of 30 days.



Papaya plants grown using bio-pesticide formulation

- By following all these methods farmers can get 16 – 24% increase in the yield of the crops.

For products or technologies of bio-pesticides - *Pseudomonas fluorescens* 1% W. P., *Trichoderma harzianum* 1% W. P., *Trichoderma viride* 1.5% W. P. and *Paecilomyces lilacinus* 1% W. P. *Pochonia chlamydosporia* 1% W. P. and product of patented technology and patented organic formulation please contact:

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INTEGRATED MANAGEMENT OF NEMATODES OF PAPAYA

Introduction

Papaya crop in many farmers' fields has been observed to have infestation of nematodes viz. *Meloidogyne incognita, M. javanica* (root-knot nematodes) and *Rotylenchulus reniformis* (reniform nematode). These nematodes are microscopic and infect Papaya starting from nursery stage. Hence, it is important to know how to produce healthy seedlings of papaya. During the process of hardening, because of the substrate mixture many times seedling roots are infected with *Heterodera sp.,* (cyst nematodes). Further, they are also infected with other pathogenic fungi and bacteria. Once these seedlings are infested the pathogen reaches the farmers field and cause the diseases in their fields. For controlling the diseases farmers use chemical pesticides which are expensive and also are hazardous.

Papaya seedlings are produced generally in substrate mixture in polythene bags. Many a times substrate mixture (sand + soil + FYM or any organic manure) harbor above mentioned nematodes and other pathogenic fungi and bacteria. Generally papaya seedling producers don't treat the soil mixture which is used for the production of papaya seedlings in their nurseries.

As such nematode infestation on the seedlings makes the way for the entry of various pathogenic fungi and bacteria. These nematodes and other pathogens multiply in the farmers' fields. As a consequence, soil in the farmers' field becomes sick and un-productive and ultimately soil becomes unfit for the cultivation over a period of time if proper measures are not taken to combat these nematodes and other pathogens.

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