

## Integrated Management of Root-Knot Nematode (*Meloidogyne* Spp.) on Cucumber under Polyhouse Condition

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### Introduction

Demand for high quality, export-oriented vegetable products and need for the availability of vegetables crop produce round the year especially in off season, compelled the growers to cultivate selected crops under protected cultivation. Protected cultivation is the form of agricultural production that aims to protect the crops from living (pests and diseases including nematodes) and non-living (climatic or environmental) stresses. It involves intensive cultivation, optimum use of fertigation and frequent irrigation. This technology has been adopted by a number of farmers in India as well as in Haryana. Farmers are commencing cultivation of cucumber, tomato and capsicum under protected cultivation. A lot of polyhouses are being erected in Haryana under the aegis of National Horticulture Mission (NHM) to grow short duration high value vegetable/ornamental crops. The changes of agricultural situations have tremendous effects on the emergence of plant parasitic nematodes (PPNs) problems in Haryana. Despite the fact, PPNs are mostly neglected and considered as low priority factor for crop production and protection in Haryana. Root-knot nematodes (RKNs) problem in polyhouse is stimulated by environmental conditions congenial for their survival. Due to controlled environmental condition and continuous growing of susceptible crops, the RKNs (*Meloidogyne* spp.) has emerged as a major problem, most destructive, causing enormous yield loss and difficult to control. The population build-up is rapid in polyhouse and the nematode population reaches five to six times the threshold levels within 18-24 months, making protected cultivation a wasteful exercise.

Continuous growing of same susceptible crop increases problem of soil borne pest and diseases including PPNs. The problem of nematode after 3-4 crops increases due to build up of initial population in first crop and shortening life cycle of nematode due to higher

temperature. In polyhouse cultivation of vegetables, *M. incognita* spreads from 10-60% of the area because of the monoculturing and accordingly yield losses may go up to several folds under such environment. The losses are more severe under protected cultivation due to favourable microclimate and continuous availability of host. In India, on an average, a national loss of Rs. 21,068.73 millions has been estimated due to PPNs. An overall average annual yield loss in major horticultural crops due to PPNs goes up to 60% under protected cultivation. Once the nematodes enter in polyhouse by any means, it is very difficult to get rid of them. Developing holistic approaches for managing polyhouse problems including PPNs inducing diseases complexes in concert with other pathogens like fungi, bacteria and viruses will be the major areas of research thrust. Managing the population nematode below damaging levels is important for reducing economic losses and sustaining productions. Several management practices including use of biological, physical and cultural practices have been used extensively over the years to minimize the losses caused by RKNs. Implementation of integrated nematode management approach can give good results in keeping nematode population below economic threshold level (Plate 2).

#### **Reason for increase in nematode population under protected cultivation**

- Continuous growing of nematode susceptible crop increases problem of PPNs and other soil borne pests.
- Low tunnels along with general poor plant hygienic conditions inside and outside the greenhouses.
- The problem of nematode after 3-4 crops increases due to build up of high nematode population.
- In most cases, problems arise from contaminated soil or soil mixture used as a component of the growing medium, mono-cropping and infested planting materials.
- Some commonly followed nematode management practices adopted in open field crops (fallowing, rotation etc.,) are not practicable in polyhouses.
- Due to congenial conditions of higher temperature, use of high agronomic inputs fertilizers, plant growth promoters and frequent irrigation in polyhouses.

#### **Symptoms**

The root-knot nematodes are sedentary endoparasitic nematodes which complete their life cycle inside the plant tissues. The common above ground symptoms of the infestation

with root-knot nematode are stunting, yellowing and wilting, but the below ground major symptom is the gall formation in roots (Plate 1). These galls formed on cucurbits are bigger in size than other crops.



**RKNs infected cucumber crop in poly house    RKNs infected cucumber root in poly house**



**Healthy cucumber crop in poly house    Healthy cucumber root in poly house**

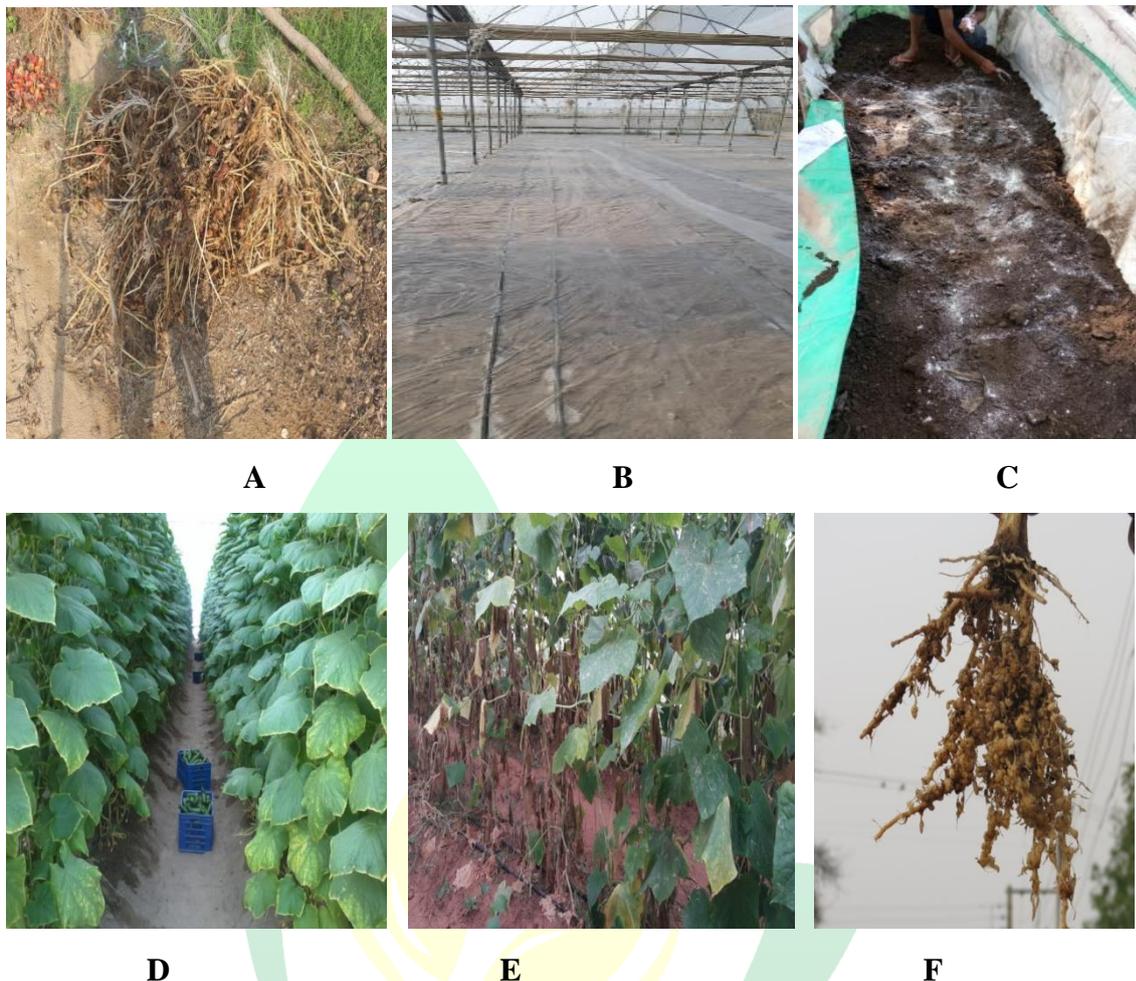
**Plate 1. Above and below ground symptoms of cucumber crop**

#### **Source of nematode infection**

- Infested soil
- Infected planting material

#### **Source of nematode spread**

- Implements used in polyhouses
- Footwear of workers
- Agricultural machinery



**Plate 2. Integrated nematode management on cucumber in polyhouses**

A. Removal of previous crop residue; B. Soil solarisation under polyhouse during summer; C. Mixing of *Purpureocillium lilacinum* in FYM; D. Picking of cucumber yield; E. Root-knot nematode infested cucumber crop under polyhouse condition; F. Heavy galling on cucumber root

### Management

For the management of root-knot nematode in the cucumber in polyhouse, take the following measures.

- Remove and destroy the plants of the previous crop along with the roots.
- Solarise the soil during summer by covering the soil with a 25µm thick transparent polythene sheet for 15-20 days, after light irrigation. Cover the edges of polythene sheet with soil to make it air tight.

- Add FYM enriched with fungus (*Purpureocillium lilacinum*) @ of 1 kg/m<sup>2</sup> in the soil. For preparing enriched FYM, mix 2 kg of fungus in 1 ton of FYM. Cover it with polythene sheet after sprinkling with water. After 10-15 days, mix it well on the paved surface.

