

Nematodes Problem and Their Control in Potato (*Solanum Tuberosum*) Crop

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Abstract

Potato (*Solanum Tuberosum*) parasitic nematodes are microscopic species that belongs to discrete class of animals. These nematodes possess stylets and mostly live in the soil. Their effects on potato plants mostly result in damage to plant parts, reduce in their growth or crop yield. Phytoparasitic nematodes which are associated with every important Potato crop and also represent a significant constraint on global food security. Cyst nematode (*Heterodera* & *Globodera* Spp.), Root-knot nematode (*Meloidogyne* Spp.), Lesion nematode (*Pratylenchus* Spp.). These ranks on the top of list of most scientifically and economically important species due to their host plants, host range and the damage level developed by infection. So, in this paper we discuss about the different types of methods that prevent the crops from nematode problems.

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1. INTRODUCTION

In all over the world Potato (*Solanum Tuberosum*) is the 4th most stable food worldwide after maize, rice and wheat and also the first vegetable and economically important food crop. This crop cultivated in several regions worldwide, especially in America, Europe and Asia. Asia and Europe are the major producers and in account for about 80% of world Potato's production and the main consumers are Asia, Europe and North America. (Khan Abrar Ahmed, 1998).

Potato has been increasing demand for food security and food supply. Unsustainable production system of crops with intensive planting, monocultures and enlargement of

crops to newly opened areas with having increase in issues associated with new pest and diseases.

Plant parasitic nematodes are important pest in agriculture. These nematodes are the costly burden in agricultural crop production (Donald C. Weber, 2013).

Nematodes are diverse, microscopic multicellular animals comprising free living to plant parasitic species. Plant parasitic nematodes are limiting factor for potato production and lead to decreased yield, physical and chemical changes in potato tubers quality and malformations which overall make them unmarketable. (Joshi and Satish Anant. 2016; Sajida Begum, 2016). Nematodes alone can

causes yield losses in potato upto 12% (Fabia S. O. Lima et al., 2018).

Nonetheless, Potato yield losses due to nematode parasitism also depend on a combination of factors including cultivator, favourable environment, soil structure, population density and the time of planting and could lead to more severe decline in yield at particular cropping systems.

2. METHODS OF NEMATODES CONTROL

Potato nematodes can be controlled by several methods. By controlling these nematodes we can improve quality, growth and yield by keeping the population of nematode below the economical threshold level.

The control measures that we use should be profitable and cost effective.

The nematode control methods are:-

- a) Regulatory(legal) control
- b) Cultural control
- c) Physical control
- d) Biological control
- e) Chemical control

a) Regulatory control:

Regulatory control of pests and diseases is the legal enforcement of measures to prevent them from spreading or having spread, from multiplying sufficiently to become intolerably troublesome.

Hormones can control the regulation of various aspects of growth and development in potato, either individually or in combination with other hormones. The molecular characterization of interplay between Cytokinins (CKs), Abscisic acid (ABA), Auxin, Gibberellins (GA) during tuber formation requires further undertaking.

Many countries maintain elaborate organizations to intercept plant shipments containing nematodes and other pest. Diseased and contaminated plant material may be treated to kill the nematodes or their entry may be avoided.

b) Cultural control:

Cultural control measures such as eliminating cull piles and volunteer potatoes, using proper harvesting and storage practices, can be used to reduce the pathogen populations by reducing its survival, dispersal and reproduction.

These control methods are agronomical practices employed in order to minimize nematode problem in the crops.

Adjusting the Time of Planting

The cycle of nematodes depends on climatic factors. By the adjusting the time of planting helps to avoid nematode damage. In some of the cases crops may be planned in winter when soil temperature is low and that will be the time nematodes cannot be active at low temperature. Early potatoes grow in soil during cold season and escapes cyst nematode damage since the nematodes are not that much active to cause damage to the crop during cold season.

Selecting Healthy Seed Material

When plants propagated by vegetative means we can eliminate nematodes by selecting the vegetative part from those healthy plants. The golden nematodes of potatoes can be eliminated by selecting the nematode free plant. Selecting of good seed is a critical decision faced by every potato grower. A good crop with good seed. The some amount of fertilizer, pesticide and effort is put into a crop from poor seed as into a crop from good seed. Choosing seed that is physiologically as well as physically healthy is important. Disease free seed is essential to good crop. Seed that is physiologically young, has been handled gently and sorted carefully is also important.

Flooding

Flooding can be adopted where there is an enormous availability of water under submerged conditions, anaerobic condition develops in the soil which kills the nematodes by asphyxiation. Chemical lethal to nematodes such as hydrogen sulphide and ammonia are released in flooded condition which kills the nematodes.

To Control Nematodes in Potatoes with Trap Crop

Planting a potato cyst nematode (PCN) trap crop can naturally reduce nematode numbers by up to 75%. (Amalraj SFA, 2016; Joshi and Vijay, 2021; Muthulakshmi M, 2011).

Trap crops aim to reduce overall PCN population numbers by deceiving nematodes by hatching by the release of chemicals from their roots. This signals the presence of the host triggering the nematodes to emerge from their cysts. However the juvenile nematodes are not able to create the necessary feeding site to develop, which prevent from multiplying and reduces numbers. (Baqri, Q. H., & Kansal, K. C. 2000).

Aimed to reduce PCN (without losing a cash crop from the rotation) through the establishment of two different trap crop species:-

Solanum sisymbriifolium

(Sticky rightshade- A small leafed plant, full of thorns)

Solanum Scabrum

(African rightshade- A larger broad leaved plant, with larger, more fibrous, roots)

Use of Resistant Varieties

Nematodes resistant varieties have been reported from time to time in different crops. Use of resistant varieties is a very effective method to avoid nematode damage. The potato variety Kufri Swarna is resistant to *G. Rostochiensis*.

c) Physical Control

It is very easy to kill the nematodes in laboratory by exposing the nematodes to heat irradiation and osmotic pressure etc., but it is extremely difficult to adopt these methods in field conditions. These physical treatments may be hazardous to plant or the men working with the treatments and the radiation treatments may have their residual effects.

Plant tissue culture of potato:

Potato can be propagated sexually and asexually by means of tubers. In this we can create a large

number of clones from a single seed or explants, select desirable traits and to eliminate plant diseases through careful selection and sterile techniques.

d) Biological Control

Predators and parasitoids which actively seek out the pest have an enormous potential to suppress potato insect pests.

Natural enemies of major potato pests:-

Potato tuberworms (*Lepidoptera: Gelechiidae*)

The larva bore into potato tubers in the field and in potato stores.

Andean Potato Weevil (*Coleoptera: Curculionidae*)

They feed modestly during the first half of the night copulating and ovipositioning numerous eggs at the base of the plant.

Potato were treated with the biocontrol organisms *Laetisariaarvalis*, *Trichoderma virens* or *Bacillus subtilis* and planted following rotation crops of barley and ryegrass, barley and clover, and potato.

The barley/ryegrass rotation significantly reduced incidence and severity of stem canker and increased tuber yield at one location.

e) Chemical Control

Pesticides have been the most widely used tactic to protect potatoes from various insect pests and disease-causing agent.

Chemical control options recommended to farmers include spraying methyl parathion, carbonyl or monocrotophos.

Plant parasitic nematodes often reside in plant tissue which makes soil delivery applications of the chemical challenging.

3. CONCLUSION

It may be concluded that the nematode had a very determined effect on growth and development of plant. However the conserved use of specific genotypes of disease resistant cultivars may contribute to increased pathogen aggressiveness resulting in epiphytotic

conditions, therefore the identification of additional resistant varieties becomes increasingly necessary for long term control.

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